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ABSTRACT

Twelve activities are presented that focus on a common phenomenon of a child's world: energy. These activities relate energy, how it occurs, how it is used, and how to use it safely. Each activity includes the purpose, introduction, background, procedure, materials, estimated time for the activity, typical results, safety notes, and more ideas. Student worksheets are provided for some steps in the procedure. Activities follow questions such as: Where does energy come from?; Can energy change things? Where does heat come from?; and How can we save energy? Safety is emphasized on many of these worksheets. Take-home letters are also provided so that parents can help children to develop safe energy habits. Included are a glossary, resource section, and a matrix where activities are cross referenced with the understandings, skills, and attitudes listed in the New York State elementary science syllabus. (KR)

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Energy and Safety:

Science Activities for Elementary Students

Level I (Grades K-2)

from the New York Energy Education Project

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Acknowledgements

To Teachers

Children and science go well together. When children are being themselves, they are being scientific: observing things, asking questions, handling objects, noticing similarities and discrepancies, figuring out how something happens.

The activities that follow try to take advantage of those things that children do naturally. We've focused on a common phenomenon in the child's world: the phenomenon of energy. We've arranged a series of experiences related to energy, to how it occurs, how it is used, and how to use it safely.

We hope that you and your students will enjoy these experiences together.

The Format

The Teacher's Pages

Each activity starts with a question. The material immediately following the question is for you, the teacher.

In the Background section, key words are underlined. These words are defined in the Glossary.

The Understandings, Skills, and Attitudes are taken from the New York State Elementary Science Syllabus, soon to be available. In a few cases the wording of the Understandings has been changed to better fit the activity.

The Procedure is arranged in numbered steps. The Materials and the Safety Notes are numbered to match the steps in the Procedure.

The Student's Pages

Student worksheets are provided for some steps in the Procedure. Safety is emphasized on many of these worksheets because the use of energy involves potential hazards in many situations. Students can learn, like scientists, to satisfy their curiosity without getting hurt.

Many activities include Take-home Letters. In most cases, the use of the letters is discretionary and not necessary to the activities. We recommend using the letters because parents and guardians can help children to develop safety energy habits. Each letter includes a space for the student's name and one for the teacher's signature.

Glossary

The key words from the Background section of each activity are defined in the Glossary.

Resources

More materials for students on the same topics are listed by activity in the Resources section. You may wish to use some of this material to introduce or reinforce an activity.

Matrix

In the Matrix the activities in this booklet are cross referenced with the Understandings, Skills, and Attitudes of the New York State Elementary Science Syllabus.

Safety Note for Teachers

Students should wear protective goggles whenever any of the following are being used:

*Hot Plates

*Any Flame (Candle, etc.)

*Rubber Bands

*Any Chemicals (Vinegar, etc.)

The use of appliances or of any flame should be handled as a teacher demonstration.

Level I Activities

Grades K-2

	Question	Purpose
1.	What makes things happen?	To help students recognize that energy causes the changes happening around them.
2.	Where does energy come from?	To make students aware that the energy that makes things happen comes from a number of different sources, and that energy appears in different forms.
3.	Can energy change things?	To allow students to experience how sunlight and heat can change the appearance and form of things.
4.	Does energy change?	To show students that the energy involved in one event can cause another event. In the process, the energy may change its form.
5.	What makes plants grow?	To make students aware of the basic needs of plants, especially the need for the sun's energy.
6.	What makes my body move and grow?	To help students understand that the energy that allows them to live and grow comes from the food they eat.
7.	Where does heat come from?	To make students aware of heat energy, how it is measured, and where it comes from.
8.	What makes things move?	To teach students that every form of transportation uses energy, and that wheels make it easier to transport things.
9.	Why do we need electricity?	To show students how many conveniences and necessities rely on electricity.
10.	Why do we need energy?	To focus student attention on the variety of energy sources and the many needs for energy in our lives.
11.	How can we save energy?	To make students aware of a few specific ways in which they can save energy.
12.	How much do I know about energy?	To help students review what they have learned about energy, energy conservation, and energy safety.

1. Question: What makes things happen?

Purpose

To help students recognize that energy causes the changes happening around them.

Introduction

The teacher will demonstrate several things happening (including corn popping) and students will make their own observations. The class will then study a worksheet that introduces the word energy, and learn a song that reinforces the concept.

Background

When something happens, it is because energy made it happen. Heat, light, and motion are forms of energy that are around us all the time and can easily be observed.

When popcorn pops, it is actually because the heat source causes moisture in the kernels to become a gas, expand, and explode the kernels.

Because energy makes things happen, it can be hazardous. Energy use should always be linked to energy safety.

Understandings

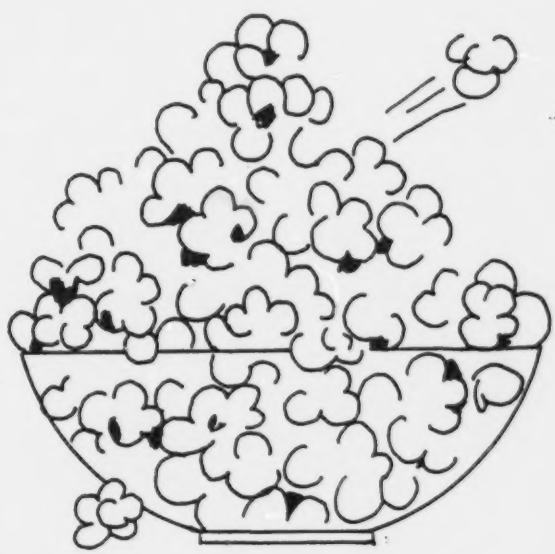
When an interaction takes place in which the properties of an object are changed, energy must be present.

Skills

Observing
Classifying
Developing vocabulary

Attitudes

Appreciating the natural world's lawfulness and consistency.



Procedure

1. Demonstrate several things happening: switch on a light, blow a pinwheel, light a candle, roll a ball, run a battery-powered toy, play a record.

   Ask each time: Did something change? Did something happen? What changed? What happened? Why did it change? What made it change?

2. Make popcorn. Ask children what they think makes the popcorn change shape and size, jump around, make noise, etc.

3. Take a ten minute survey of things happening: a classroom survey (or looking out the window), a school survey (playground or lunchroom would be good), or a neighborhood survey (a walk around the block). Make a list of what happened and what made it happen. Try to classify the events as examples of light, heat, or motion. (Some will be more than one).

4. Use the "Energy makes things happen" worksheet to introduce the word energy. Have children color the pictures of things happening because of energy. Discuss the energy safety reminders.

Ask: Can things with heat and light hurt you? Can things that move hurt you?

5. Teach the energy song. Have children pantomime the things happening in the song.

Materials

1. candle, matches, ball, pinwheel, battery toy, record and phonograph, etc.

2. stove, hot plate, or automatic corn popper; pan with lid, butter, oil, popcorn, bowl, or prepackaged corn, ready to pop

4. Energy makes things happen sheet

5. The Energy Song sheet

Estimated Time for Activity

2 - 3 hours

Typical Results

Students will probably find the concept of energy too abstract to grasp. They should, however, be able to recognize causation in some of the events they observe.

Safety Notes

1. Don't leave candle lit.

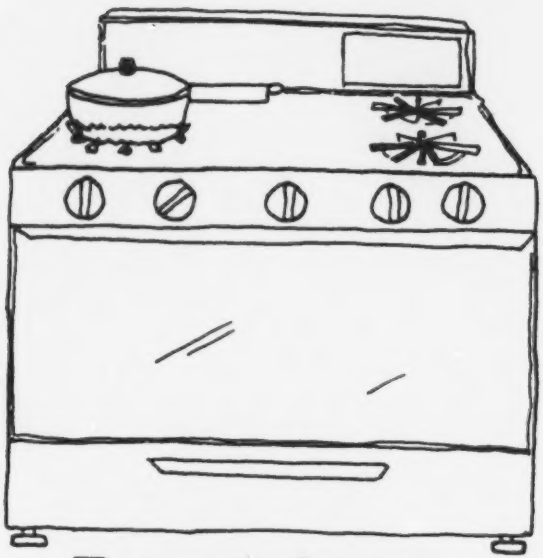
2. Don't walk away from heat source while making popcorn. Once the pan gets hot, keep it moving and hold the lid on. If using a hot plate, place on the floor so children can see without getting too close.

More Ideas

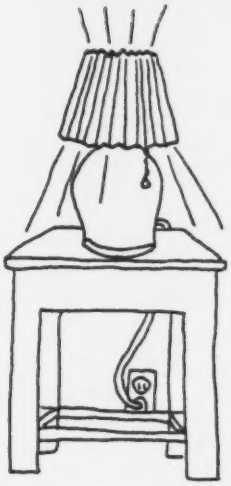
Have the children draw pictures of themselves doing something. Label the picture I HAVE ENERGY or JUDY HAS ENERGY.

Pantomime things happening, and have children guess what is being acted out.

Energy makes things happen.



Energy heats.



Energy lights.

Energy moves things.

Be an energy safety watcher.

Don't touch a hot pot.

Don't play with matches.

Don't skate in the street.

The Energy Song

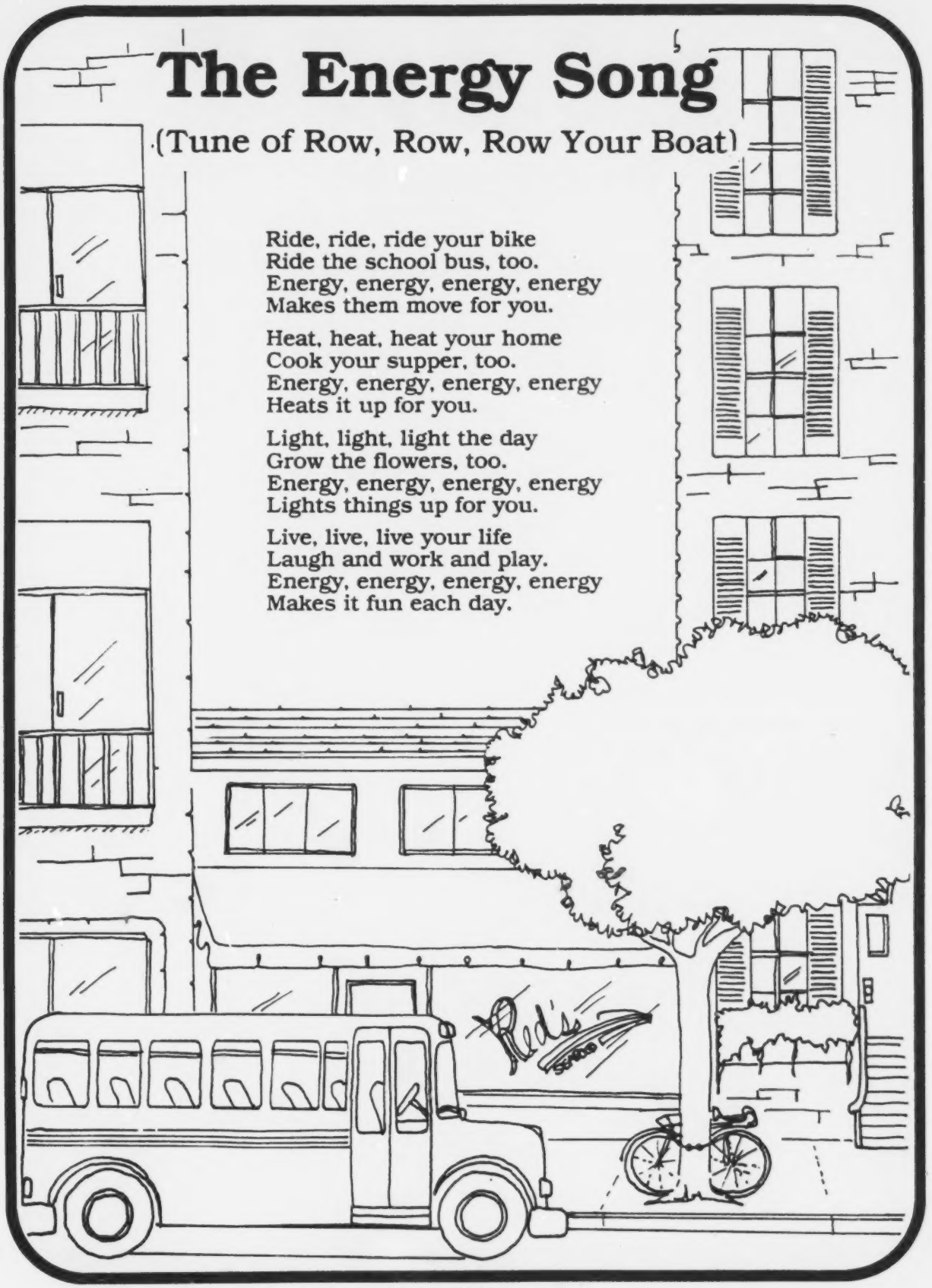
(Tune of Row, Row, Row Your Boat)

Ride, ride, ride your bike
Ride the school bus, too.
Energy, energy, energy, energy
Makes them move for you.

Heat, heat, heat your home
Cook your supper, too.
Energy, energy, energy, energy
Heats it up for you.

Light, light, light the day
Grow the flowers, too.
Energy, energy, energy, energy
Lights things up for you.

Live, live, live your life
Laugh and work and play.
Energy, energy, energy, energy
Makes it fun each day.



To _____ Folks,

This week the class is learning about how ENERGY MAKES THINGS HAPPEN. You can help by talking about what makes things happen, especially things that light, heat, and move.

Thank you!

_____

2. Question: Where does energy come from?

Purpose

To make students aware that the energy that makes things happen comes from a number of different sources, and that energy appears in different forms.

Introduction

Students will experience energy in the form of sunlight, wind, magnetism, food, and fuel. They will learn the names of these different sources of energy, and write them on a worksheet.

Background

Energy can be confusing, because it comes in many different forms, from many different sources. The heat and light of the sun, the push of the wind and the pull of a magnet are easier to understand because they are kinetic energy; we can see or feel them. Food and fuel are more complicated, because they are potential energy, energy stored in chemical form. Burning them helps children to see that they contain energy.

Understandings

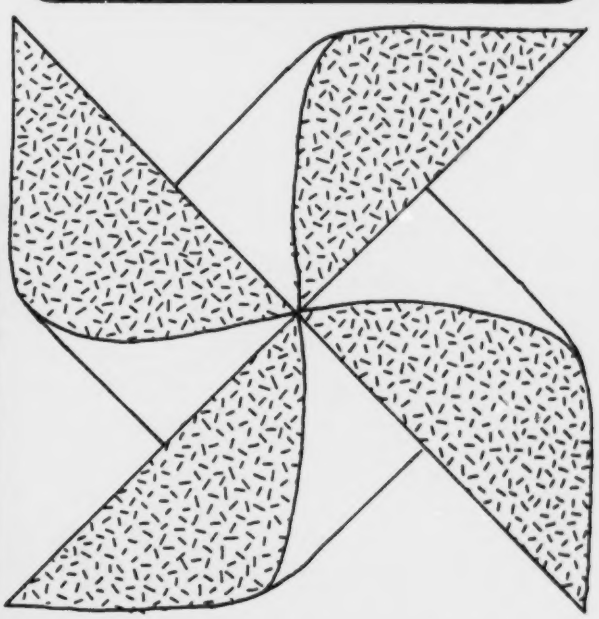
The sun, the wind, magnets, food, and fuels contain energy which can change the properties of objects.

Skills

Manipulating materials
Observing
Predicting
Developing vocabulary

Attitudes

Appreciating the natural world's complexity and diversity.



Procedure

1. Pass around a black object or objects: black paper, plastic garbage bags, pieces of wrought iron.

   Ask students: How does it feel?

   Place some objects on a sunny windowsill, and some in the shade.

   Ask: What do you think will happen?

   After ten minutes, have students touch them.

   Ask: Do you notice anything different? Has anything changed? Where did the heat come from? Does the sun have energy?

   Write the word SUN on the board.

2. Ask: Where else can we get heat from?

   Show children a peanut and a piece of balsa wood. Ask if they are energy, or if they contain energy. Introduce the word fuel. Burn the two objects in metal ashtrays. Point out that food is a fuel, because it makes our bodies go. Write FOOD and FUEL on the board.

3. Use the pinwheel pattern to make pinwheels. Tape the pencil shafts to the frame of an open window.

   Ask: What is happening to the pinwheels? What makes that happen? What other things does the wind move?

   Write WIND on the board.

4. Spill some paper clips, and use a magnet to pick them up. Talk about the energy of magnetism. Have the children experiment to find out what objects are attracted to magnets and what are not. Write MAGNET on the board.

5. Have children study the "We can get energy from...." worksheet. Tell them to select a word from the board to fill in each set of blanks on the sheet. Discuss their answers, and the safety message on the worksheet.

Materials

1. black objects (plastic, metal, or paper are best)
2. a peanut, a piece of balsa wood, two metal ashtrays, matches
3. pinwheel pattern duplicated on paper, straight pins, pencils with erasers, tape, scissors
4. paper clips, magnets
5. "We can get energy from...." worksheet, pencils

Estimated Time for Activity

1.5 hours

Typical Results

Black objects will heat up noticeably in direct sunshine. The nut and the wood will only burn for 30 seconds or so. You may need to open another window or door to establish a draft for the pinwheels.

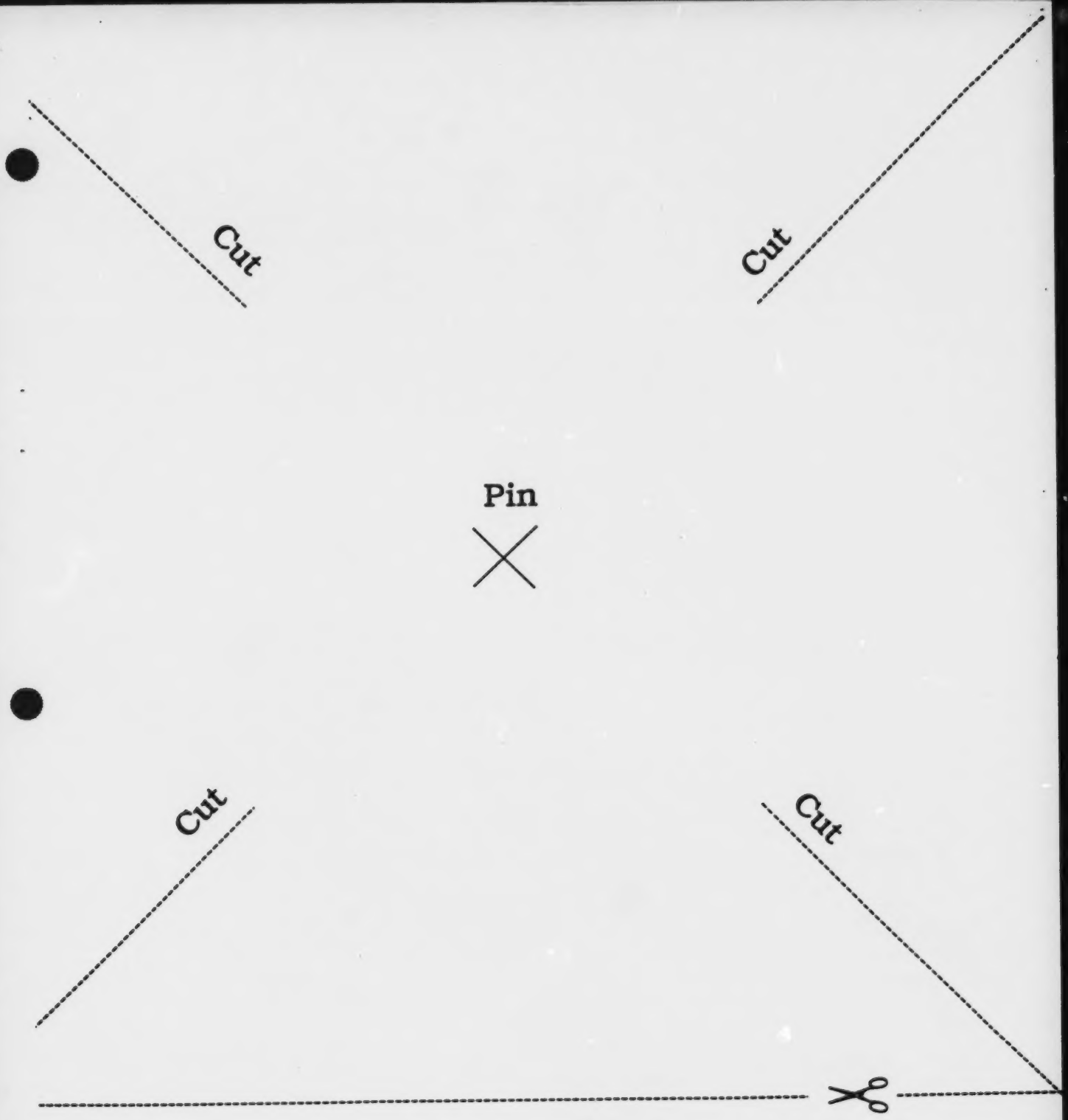
Safety Notes

2. Do burning as a demonstration only. Be sure objects burn out completely and are safely disposed of.
3. Supervise cutting and pinning.

   Do taping yourself so pinwheels (and children) don't fall out the window.

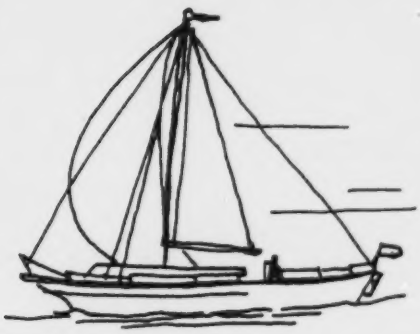
More Ideas

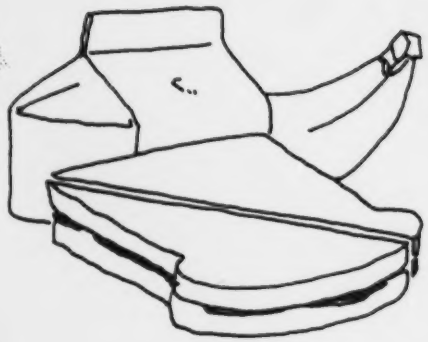
Have the children construct a water wheel from cardboard, paper cups, and a pencil. Hold it under running water to show how the water spins the wheel. Talk about how running water can be used to run machines.



Pinwheel Pattern

We can get energy from ...





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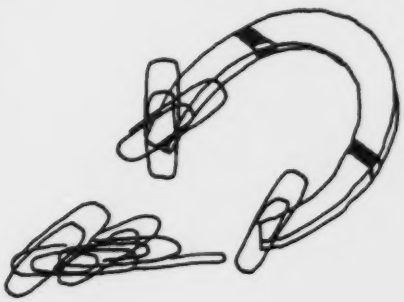

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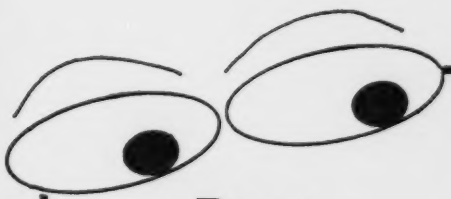
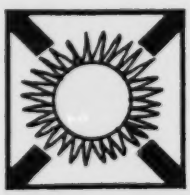


Be an energy safety watcher.



Don't look at the sun.

Don't play with fuels.

To _____ Folks,

Now the class is learning that ENERGY COMES FROM MANY SOURCES. The class has talked about the sun, the wind, magnets, food, and fuel. You can help by pointing out examples of these different sources of energy.

_____

3. Question: Can energy change things?

Purpose

To allow students to experience how sunlight and heat can change the appearance and form of things.

Introduction

Students will fade colored paper in designs using sunlight, and will observe ice melting, water boiling, and vapor condensing. They will study a worksheet that connects the sun's energy with the water cycle.

Background

Things around us are continually moving and changing. This movement and change shows the interaction between energy and objects.

The water cycle is a good example of this constant energy-driven movement and change. The sun's energy provides heat to melt snow and ice and turn water to vapor. When the heat energy escapes, water condenses into clouds and rain, and sometimes freezes to snow and ice.

Understandings

Some properties of an object are dependent on the conditions of its present surroundings. The properties of an object can be changed.

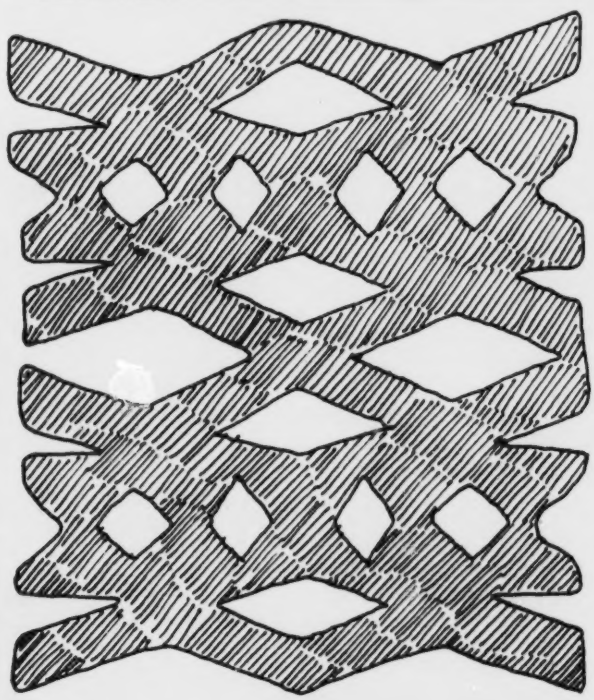
Skills

Manipulating materials
Observing
Measuring
Recording Data

Attitudes

Wanting to know about and understand the natural world.

Enjoying working with materials.



Procedure

1. Have children cut designs in folded paper to make doilies or collect leaves and arrange in designs. Tape these to construction paper (blue is best) and tape to windows, facing outward. (See illustrations.) After one day the blue paper will fade noticeably where it is exposed to the sun, leaving an unfaded design.

2. Put a wet sponge in a dish on the windowsill in the sun. By the time the children take down their paper fades, the sponge will probably be dry.

3. Ask: What changed the paper? Where did the water in the sponge go? What made it go?

   Talk about other examples of the sun's energy (tan, sunburn, melting ice cream, softening asphalt).

4. Fill a pan with ice. Use a hot plate or stove to demonstrate how heat can melt the ice. When all ice is melted, measure the water level with a ruler and record. Then continue to heat the ►

water until a noticeable amount has boiled away. Remove from the heat and measure again.

Ask: Where is the water going?

Hold a cookie sheet over the pan as the water boils and have the children watch drops condense on it. Talk about how hot steam (vapor) can be, and caution them about safety.

5. Give children the water cycle picture. Talk about how ice, snow, water, and vapor are all water in different forms. Show how the sun acts like the hot plate, to change ice to water and water to vapor. Have children color the picture.

Materials

1. white paper, blue construction paper, scissors, transparent tape
2. sponge, water, dish
4. sauce pan, cookie sheet or small mirror, piece of glass, hot plate or stove, ice, ruler, pencil, paper
5. The sun's energy... sheet, crayons

Estimated Time for Activity

2 hours

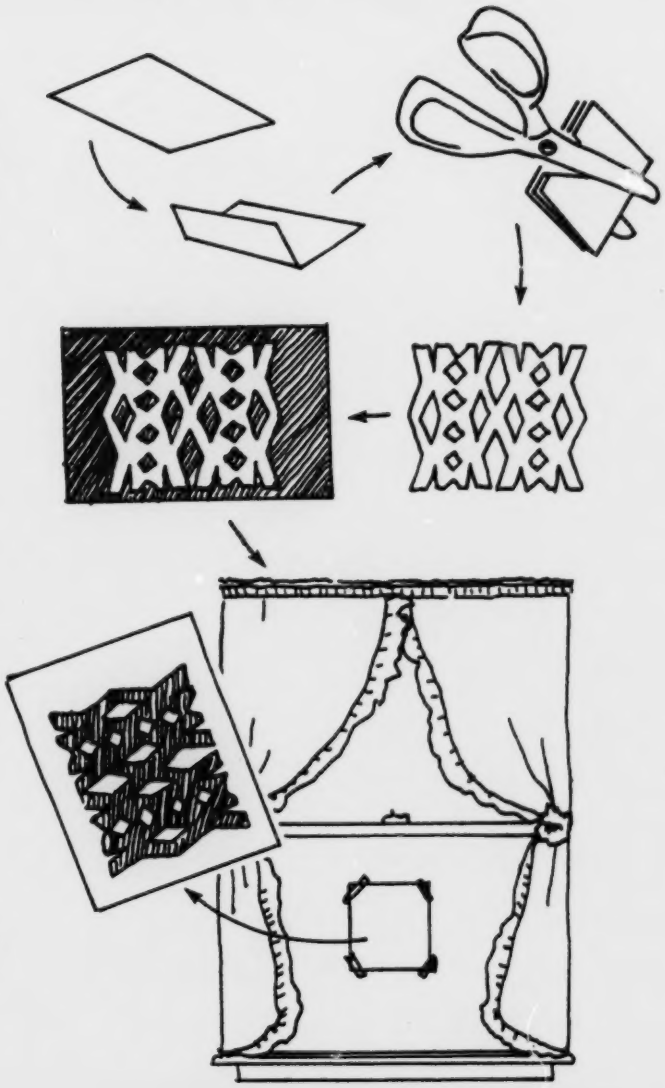
Typical Results

The paper fade and boiling away the water are concrete phenomena, easy for the children to observe. However, the concept of the water cycle is a rather abstract one. You will need to reinforce it with examples: melting snowmen, puddles that dry up, etc.

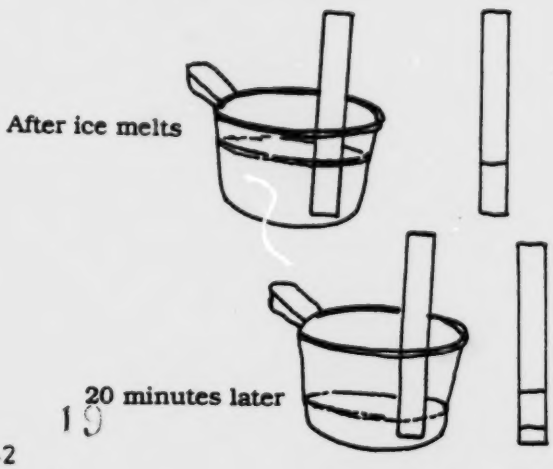
Safety Notes

1. Supervise scissors work.
4. Do the hot plate activity as a demonstration only. Be careful not to put your face or hands in the steam when measuring or demonstrating, and caution children about steam.

Making a Paper Fade



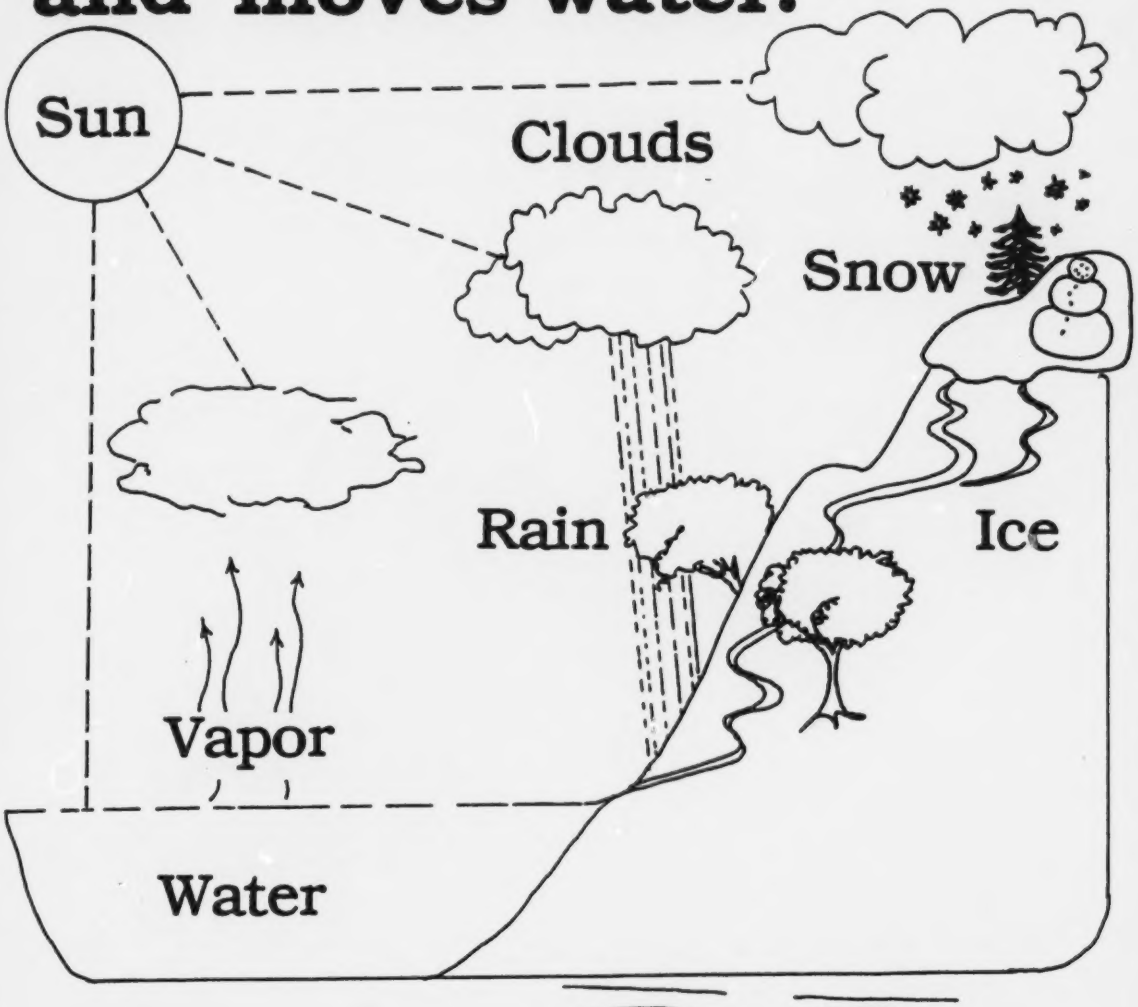
Ice to Water to Vapor



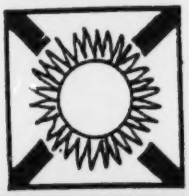
More Ideas

Slice an apple. Weigh all the slices together. Spread them on a rack with some plastic netting over and under them to keep flies away. Leave them in the sun for three days and then weigh again. Talk about why the slices have lost weight (evaporation).

The sun's energy changes and moves water.



Heat can burn. Don't touch things that are cooking.



Don't stay in the sun too long.

Be an energy safety watcher.

Watch out for steam!

To _____ Folks,

The class is learning about how ENERGY MOVES AND CHANGES THINGS. We talked about how ice, water, and water vapor are the same thing in different forms, and how heat makes ice change to water and water change to vapor or steam.

When you heat water on the stove, please remind your child that steam contains a lot of heat and can burn.

_____

4. Question: Does energy change?

Purpose

To show students that the energy involved in one event can cause another event. In the process, the energy may change its form.

Introduction

Students produce heat from friction, sound from moving air, and light from batteries. They then study pictures of familiar situations, and sequence them to show events involving energy changes.

Background

Energy exists in many forms: motion, heat, light, sound, electricity, fuel, etc. Sometimes one form of energy changes to another, and sometimes it flows from one object to another. When this happens, useful work can take place.

Stored energy can be released to do work. For example, the chemical energy in batteries can produce electricity, which can then produce light. Or a fuel like gasoline can be burned to produce heat in an engine, and the expanding heated gases cause motion which makes a car go.

Understandings

Events may occur in a particular sequence over time and in a particular order in space.

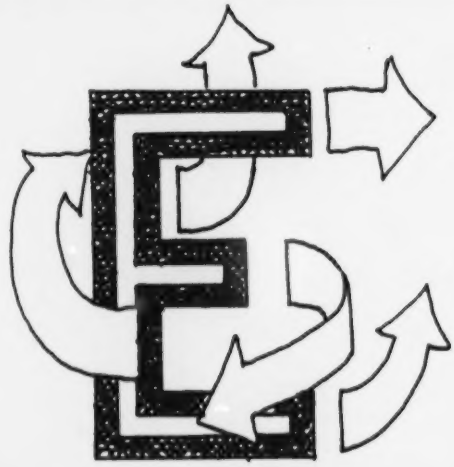
Energy can be changed in form by interactions with materials.

Skills

Observing
Classifying
Replicating

Attitudes

Wanting explanations and interpretations of information which clarify and lead to accurate predictions.



Procedure

1. Have children touch one hand to their faces, then rub their palms together vigorously for 30 seconds, then touch their faces again.

   Ask: Why did your hands get hot? Do things always get hot when you rub them together?

   (The friction between objects in rapid motion converts some motion energy to heat. A saw heats up when it saws wood. A satellite will burn up on reentering the atmosphere if not protected.)

2. Have children hold a hand in front of their faces and blow.

   Ask: What do you feel? What pushes your breath? Can your breath push other things?

   Blow a pinwheel to show that their breath can move things. Then blow across the mouth of an empty bottle. Point out that sound is another kind of energy.

   Ask: Where did the sound come from?

Let students try making sound with bottles of different shapes and sizes.

3. Assemble the battery board (see illustration). Have children move and manipulate wires to see where they should touch to make the bulb light up.

   Ask: What makes the light in the bulb? Do the batteries have energy in them?

   (Actually, a battery works something like water behind a dam being pulled by gravity. When you make a channel for the water, it will flow downward.

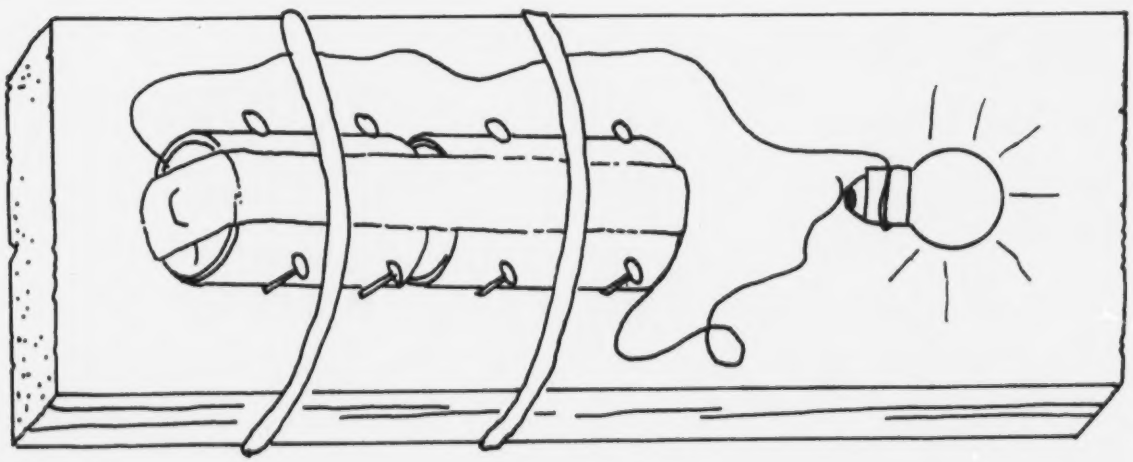
   The chemicals in a battery exert a pull on electrons. When you connect a wire to the two ends of the battery, electrons flow through the wire. When they flow through the fine wire filament of the light bulb, the filament heats up and glows.)

4. Go over the Energy Storyboard with the children. Review how the motion of their hands produced heat, the motion of their breath produced sound, and the batteries produced electricity which produced light. Let them color the storyboard.

5. Go over the Energy Forms pictures. Talk about what each one is, and about using each one safely. Have the children cut out the energy forms pictures, and arrange them on the Make Energy Stories sheet. Talk about each story to be sure children understand. Then let them glue or tape the pictures down and color them.

Battery Board

1. Line up batteries positive to negative.
2. Tape the ends of the wires to the contact points of the batteries and the bulb.
3. Experiment with wires to make contacts work so bulb lights.



Materials

2. pinwheel, empty bottles with narrow necks

3. board approximately 3" x 6", two flashlight batteries, 8 nails, hammer, 2 pieces of insulated wire stripped bare at ends, 4 strong rubber bands, a flashlight bulb, tape

4. The Energy Storyboard sheet, crayons

5. The Energy Forms picture sheet and the Make Energy Stories sheet, scissors, glue, crayons

Estimated Time for Activity

2 hours

Typical Results

The purpose is not to have students understand the physical processes, and they

will not. But they will see that with certain conditions, they can expect certain results. On the Make Energy Stories sheets, the geometrical shapes will help students to sequence the events.

Safety Notes

2. Have different students use different bottles, to avoid spreading germs.

3. Make sure batteries are fresh and not leaking. (Flashlight batteries do not generate enough current to be felt as a shock.)

5. Supervise scissors work.

More Ideas

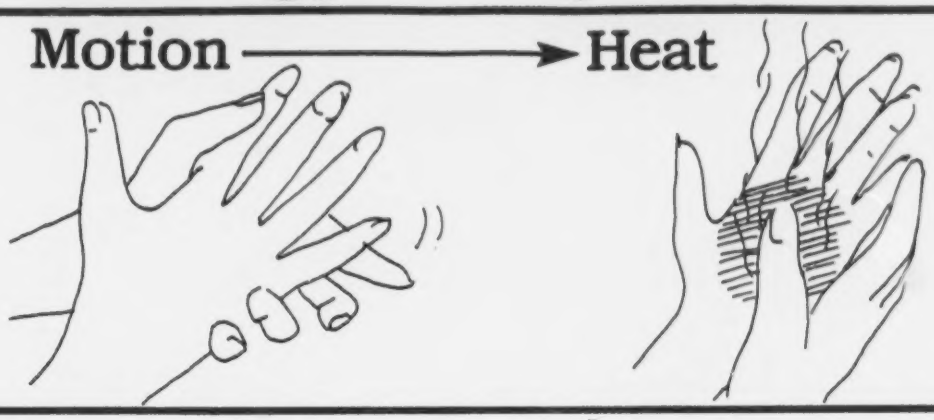
Have the children find an "energy story" at home and draw pictures to show it. It could center around a battery-powered toy, a hair dryer, a video game, etc.

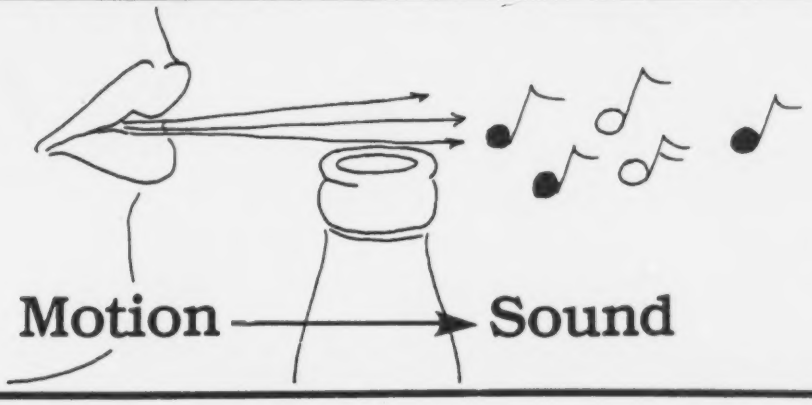
Find information on how early people started fires with friction: rubbing two sticks together, using flint and steel, etc.

Play a "wind power game" where two students on opposite sides of a table each try to blow a ping pong ball off the opponent's side.

Energy Storyboard

Motion → Heat

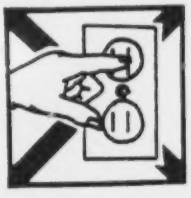




Motion → Sound

Batteries → Electricity → Light

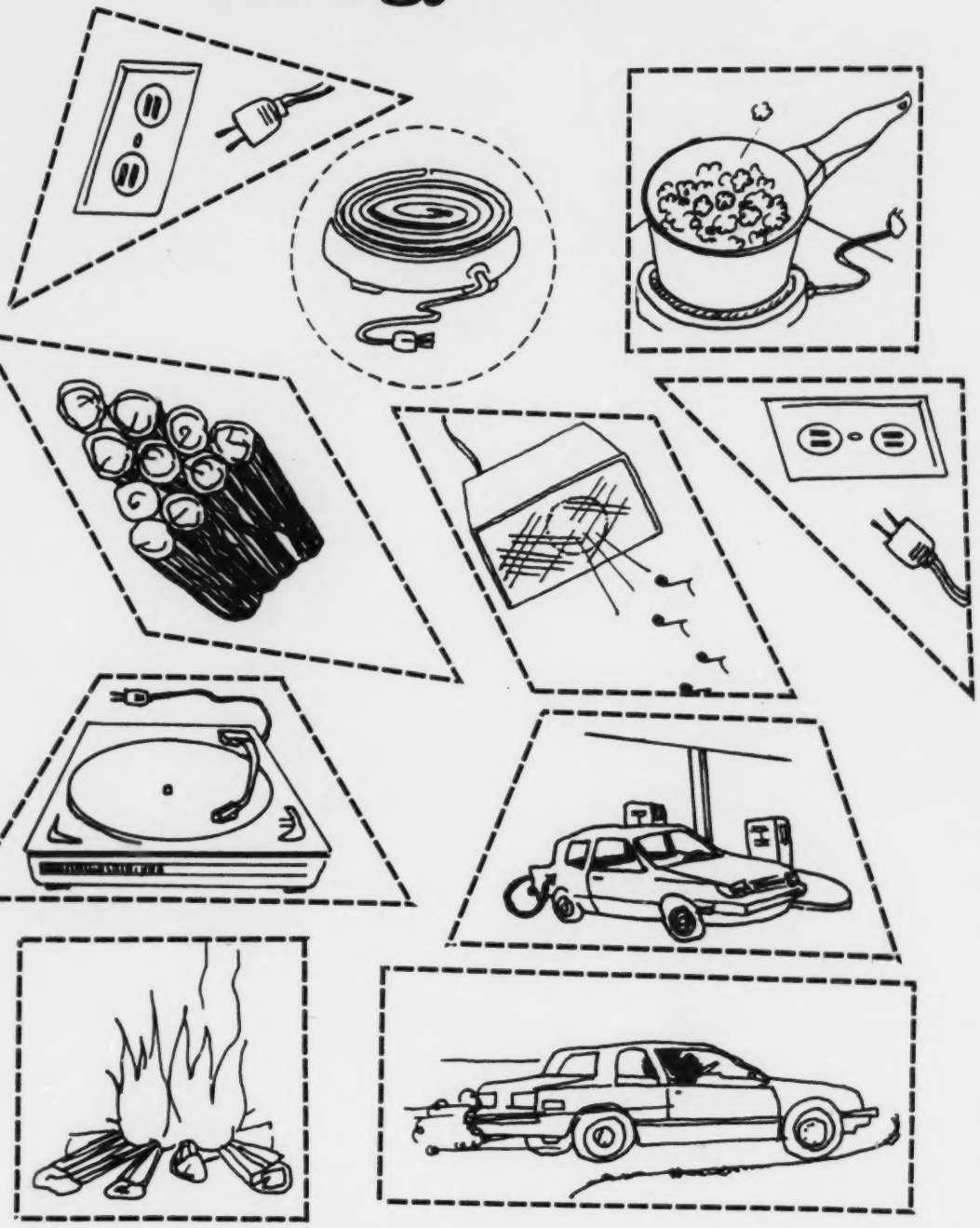
Be an energy safety watcher.



Electricity can be dangerous.

Don't touch!!

Energy Forms

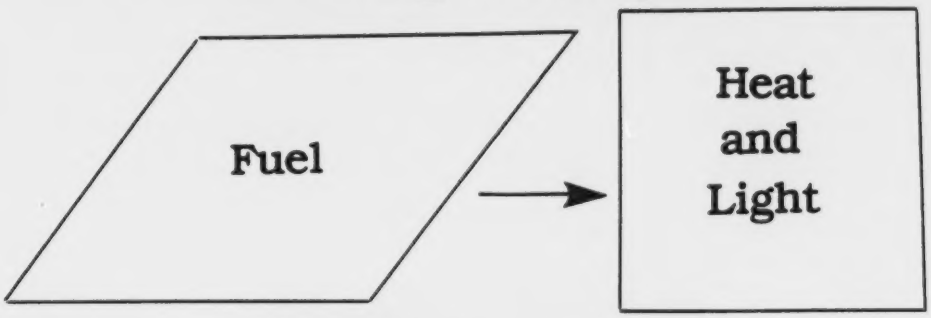


Which pictures above show things you should be careful of?

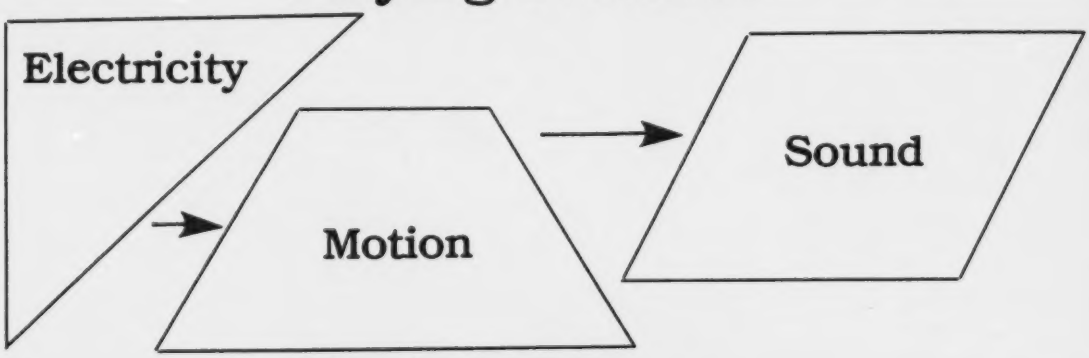
Be an energy safety watcher.

Make Energy Stories

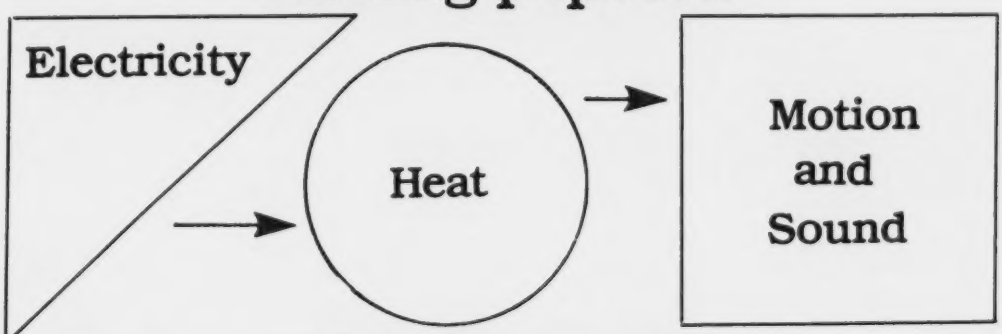
Making a campfire



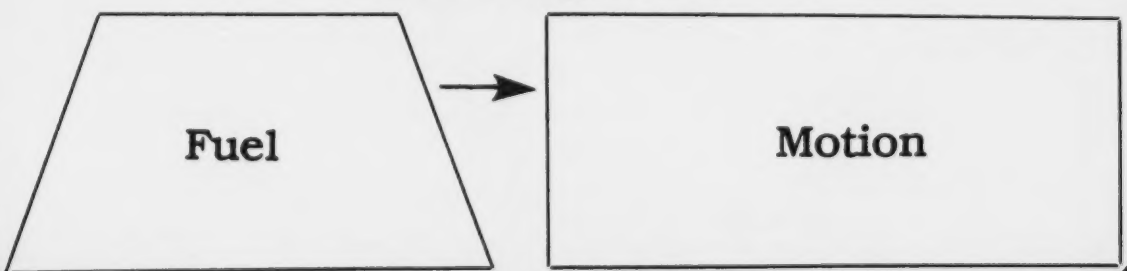
Playing a record



Making popcorn



Driving a car



To _____ Folks,

As the class learned today, ENERGY CAN CHANGE FROM ONE FORM TO ANOTHER. When these changes take place, things happen and work gets done. You can probably show your child many energy changes that are happening in your home or neighborhood.

_____

5. Question: What makes plants grow?

Purpose

To make students aware of the basic needs of plants, especially the need for the sun's energy.

Introduction

Students will sprout bean seeds and observe how plants seek light. They will study a worksheet on the things plants need in order to grow.

Background

Plants use the sun's energy to combine carbon (from carbon dioxide in the air) with hydrogen (from water). The result is carbohydrates, energy stored in plants in chemical form.

Plants also provide other substances which are necessary for animal life: minerals from the soil, and vitamins. But it is the carbohydrates in plants that give animals (including humans) their energy.

The movement of plants in response to sunlight is called phototropism. With some plants this movement is very slow and hard to recognize, but with young bean plants the leaves will reorient themselves in a day.

In reality, the seed does not need sunlight to sprout. The seed itself contains enough stored energy to get the roots started. After leaves form, the seed's job is done and the leaves take over.

Understandings

Plants live and thrive when their needs are met.

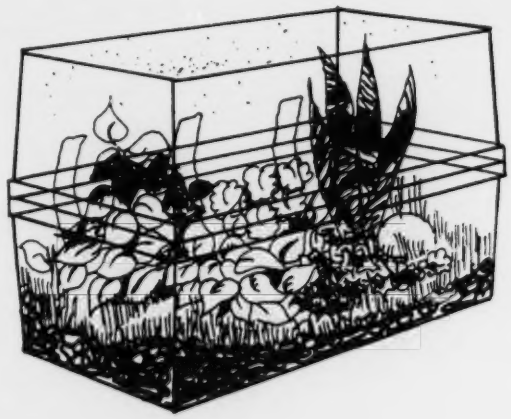
Skills

Observing
Manipulating materials
Developing vocabulary

Attitudes

Appreciating the natural world.

Wanting to know about and understand the natural world.



Procedure

1. Distribute bean seeds, paper towels, and clear plastic cups to children. Have each child prepare a cup with his/her name on it, lined with wet paper towel. Place bean seed between the towel and the side of the cup and place in the sun. Keep moist (but not floating) at all times. Beans will sprout in 3-5 days. Have children observe how roots grow and develop, and discuss what happened.

2. Start a few bean seedlings 3 weeks in advance. Use the plants to demonstrate how leaves follow the sunlight. Put the plants in the classroom window well in advance, so the leaves are oriented outward when you start.

   Ask: Which way are the leaves facing? Why are they facing that way?

Mark the side of the pot which most of the leaves face. Turn the pot so the opposite side faces out. Have students observe the plant each day, noting how the leaves gradually turn back toward the light.

3. Talk about how plants use the sun's energy to grow. Use the Plants use . . . worksheet as an illustration.

   Ask: What would happen to a plant that had no sunshine?

Materials

1. bean seeds, paper towels, clear plastic cups, water, sunny windowsill, tape, felt pen
2. one or more 3-week-old bean seedlings
3. Plants use . . . sheet

Sprouting bean seeds

Dampen a paper towel.

Use a clear plastic cup.

Line the cup with the towel. Place a bean between the towel and the side of the cup.

Keep the towel moist, and watch the bean sprout.

Estimated Time for Activity

1 hour total (over several days)

Typical Results

Students can see noticeable growth in their beans' roots from day to day. They may connect water, rather than sunlight, with plant growth, and reinforcement of the importance of sunlight may be necessary. (See More Ideas.)

Safety Notes

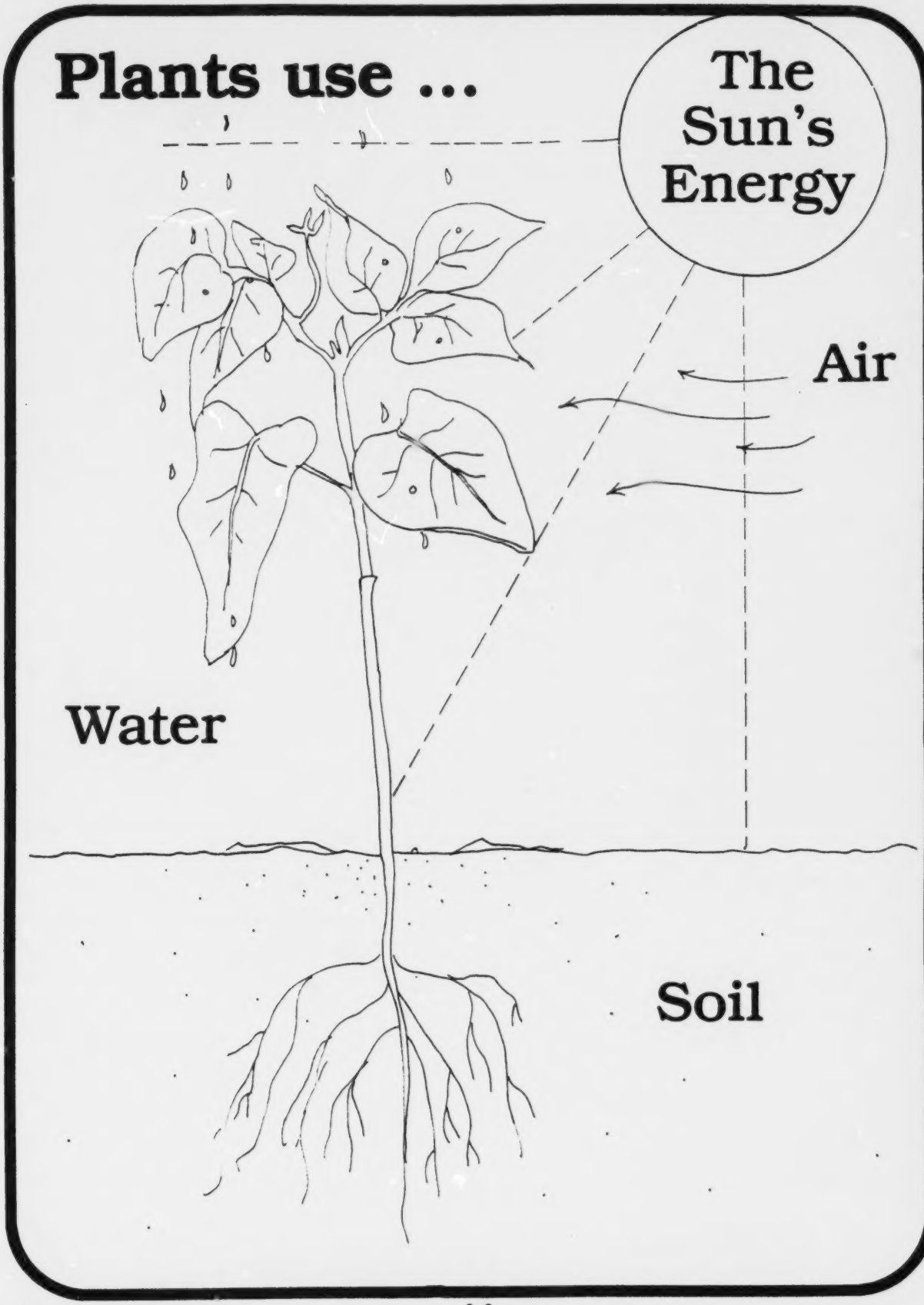
None

More Ideas

Pot the bean seeds (Procedure Step 1) after they have sprouted. Experiment with different lighting, watering patterns, and soils. Try some seedlings in low or no light.

Make terrariums out of large jars or plastic shoe boxes. Use them to observe plant growth and the water cycle.

Visit a garden, greenhouse, or park to observe the plants there.


Plants use ...
The Sun's Energy
Air
Water
Soil

To _____ Folks,

This week the class is learning about how PLANTS USE ENERGY TO LIVE AND GROW. Your child understands that plants need sun and water, and can probably help you to take care of plants at home.

_____

6. Question: What makes my body move and grow?

Purpose

To help students understand that the energy that allows them to live and grow comes from the food they eat.

Introduction

Students will become aware of their own ability to move and grow. They will compare their food to a car's gasoline, and study a worksheet that shows food chains.

Background

Plants use the sun's energy to manufacture carbohydrates (sugars and starches) and fats. Animals consume plants (and other animals) to get the energy stored in them. Protein, vitamins, and minerals are important also, as "building materials," but the energy that keeps us warm and moving and growing comes from carbohydrates -- and so, indirectly, from the sun.

We release the energy in fuel by burning it. We release the energy in food by oxidizing it with the air we take into our lungs -- the same thing as burning, but slower.

Understandings

Plants and animals live and thrive when their needs are met.

Plants and animals are dependent on other plants and animals.

Skills

Observing
Measuring
Questioning
Inferring

Attitudes

Respecting life in the natural world.

Appreciating the natural world as an essential resource in fulfilling human needs.

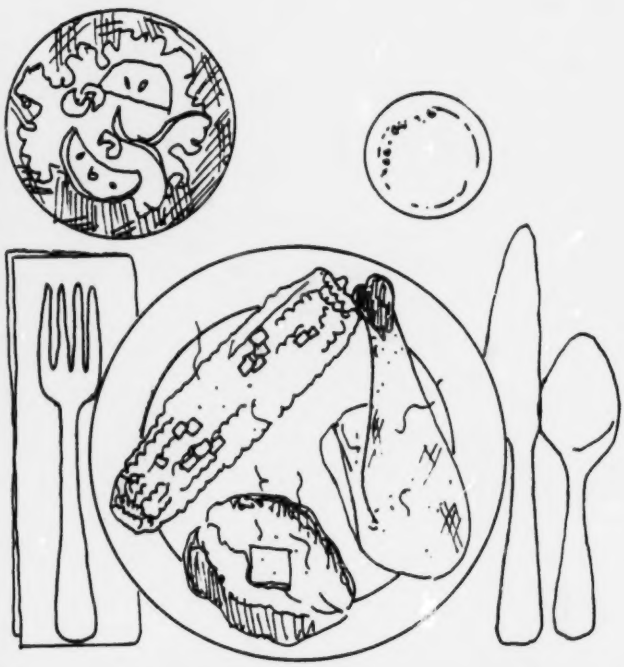
Procedure

1. Measure each child's height by making marks with different colors on a piece of shelving paper taped to the wall. Write each child's name next to the height mark.

   Ask: How big were you when you were a baby? Are you bigger now? Are you bigger than you were last birthday? Why do you keep growing? Are you going to be as big as me someday?

2. Play "Simon Says." Use the game to act out previous lessons. "Simon says act like popcorn." "Simon says grow like a plant," "Drive like a car."

   After the game ask: Can you always move and jump? What makes popcorn jump and pop? What makes plants grow? What makes a car go? Do you know what makes you go?



Compare their bodies to plants or cars.

Ask: If you kept a plant in the dark with no water, what would happen? If you didn't put any gas in a car, what would happen? What do you think keeps you going? What makes you grow? How do you feel if you miss your lunch or supper?

3. Use the Where do we get our energy? sheet to discuss the food chain from the sun to us. Have children color the food chains. Talk about why a good breakfast is important to give them energy all day.

Materials

1. shelving paper, masking tape, felt pens of various colors.

3. Where do we get our energy? sheet, crayons

Estimated Time for Activity

1-2 hours

Typical Results

Students can usually connect fuel for a car with food for their bodies. However, they may be confused about where food comes from. The connection with the sun is not as important at this level as the idea that food gives them energy.

Safety Notes

None

More Ideas

Have each student make up his/her own food chain for a favorite food, and draw and color it.

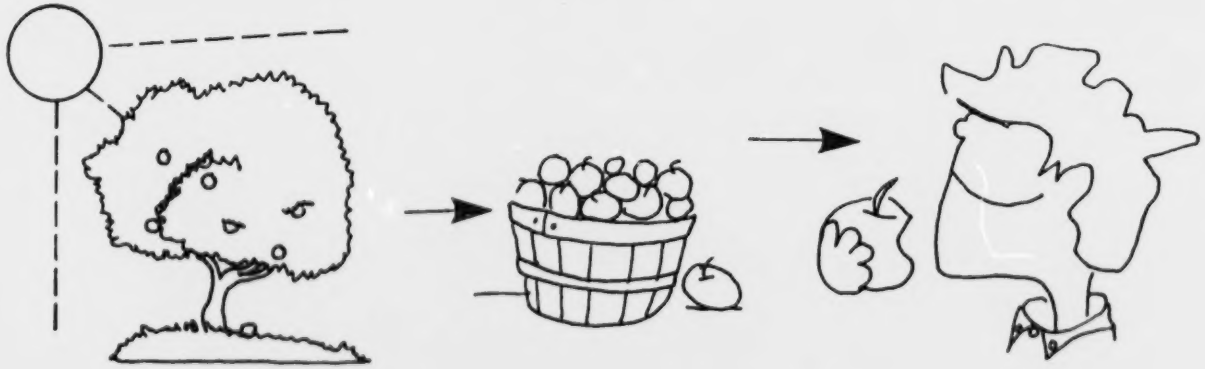
Have children keep a lunch diary for a week, by listing (or drawing) what they had for lunch each day.

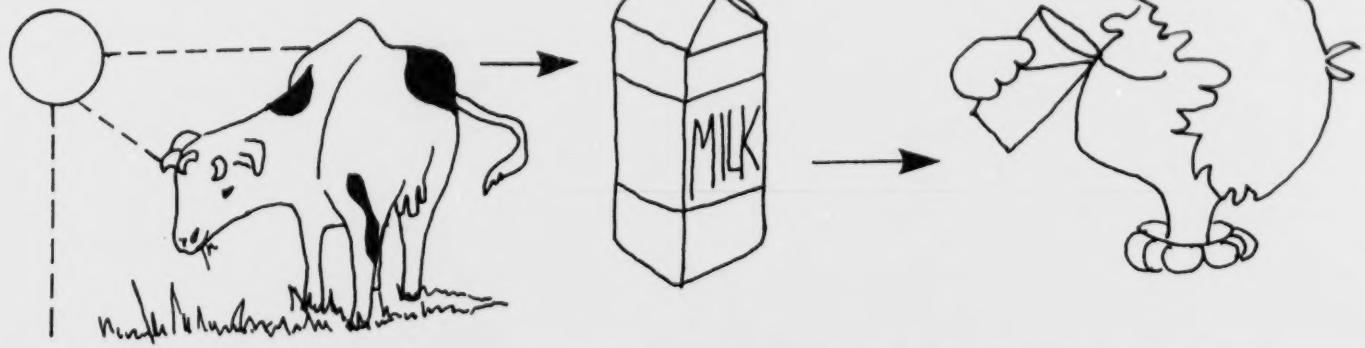
Act out food chains with students playing different plants and animals, connected with colored yarn.

Where do we get our energy?

Be an energy safety watcher.

Eat a good breakfast every day.





6-3

To _____ Folks,

The class is learning that WE NEED FOOD ENERGY TO MOVE AND GROW. Plants get their energy from the sun, and animals (including people) get their energy from plants. It might be interesting to talk at breakfast or supper about where the things you are eating come from and how they get to your table.

_____

7. Question: Where does heat come from?

Purpose

To make students aware of heat energy, how it is measured, and where it comes from.

Introduction

Students will discuss and observe familiar hot and cold objects. They will see how a thermometer reacts to heat or cold. They will also find out how their homes are heated and learn that there are several ways of heating homes.

Background

Things can be hot, cold, or in between. We use a thermometer to measure whether something is hot or cold. Heat causes the fluid in the thermometer to expand, filling up more of the tube.

In cold weather, the energy we heat our homes with may come from burning oil, natural gas, coal, or wood, or using electricity or sunlight. The energy to produce this heat must be gotten to our homes, and different methods are used to get it there.

Understandings

Animals, including humans, are able to control some conditions around them.

Skills

Observing
Questioning
Measuring
Recording data

Attitudes

Appreciating the natural world as an essential resource in fulfilling human needs.

Procedure

1. Begin with a game: "I'm Thinking of Something Hot." Have children guess what you're thinking of. Then alternate with "something cold." Have some of the children take turns to think of something.
2. If possible, have children handle ice cubes, put their hands in front of hot air vents or touch sunny windowsills, and talk about how hot things and cold things feel different. Use the Hot or Cold? sheet to compare the two concepts.
3. Pour cups of hot and cold tap water. Put a thermometer in the cold water.

   Ask: Where is the red line of the thermometer?

   Move the thermometer to the hot cup.

   Ask: What is happening to the red line?
4. Have children color the Hot or Cold? sheet, circling the hot objects in red

and showing the red level as high on the "hot" thermometer, and low on the "cold" thermometer.

5. Talk about where heat comes from: on a hot summer day, when they cook their food, when they go indoors on a cold winter day. Use the Where does the heat come from? sheet to compare three major sources of heat: the sun, electricity, and burning fuels.

   Ask: Do you know what keeps your house warm in the winter? Does the sun help? Do you have a furnace? a wood stove? Does electricity heat your house?

6. Have children take home the letter and survey. Compile the results on the blackboard the next day. Use the How do we heat our homes? sheet to talk about different kinds of homes and heating. Talk about how different kinds of energy get to our homes. Have each child color the picture(s) that are like his/her home (may be a combination of two or more).

Materials

2. hot and cold objects or locations, the Hot or Cold? sheet

3. 2 cups (preferably transparent plastic), an easy-to-read thermometer

4. the Hot or Cold? sheet, crayons

5. The Where does the heat come from? sheet

6. Letter/survey, How do we heat our homes? sheet, crayons

Estimated Time for Activity

2-3 hours (over several days)

Typical Results

Students should have sufficient experience to grasp the "hot/cold" concept. They may not be able to read the thermometer; wiggle it so that the red line is visible from different angles.

Safety Notes

2. Radiators and air vents may be dangerously hot.

3. Make sure hot tap water is not scalding.

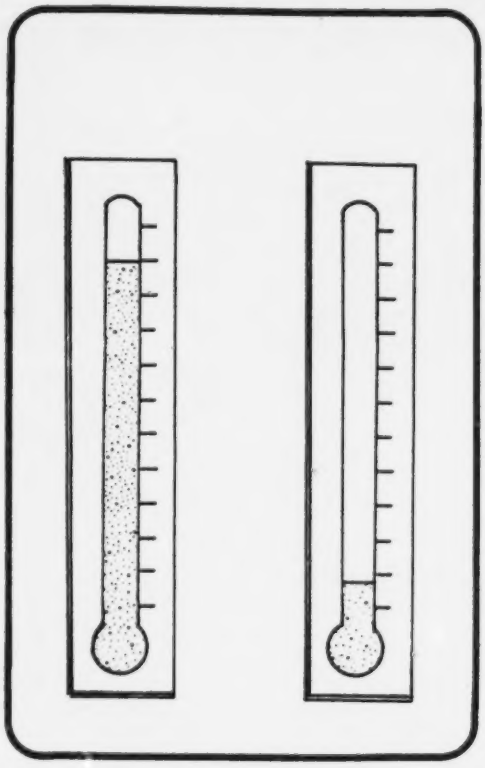
6. You may wish to tailor the take-home survey to suit your particular community.

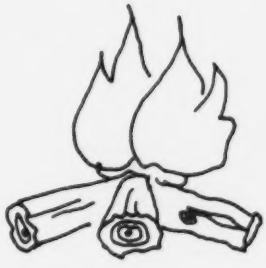
More Ideas

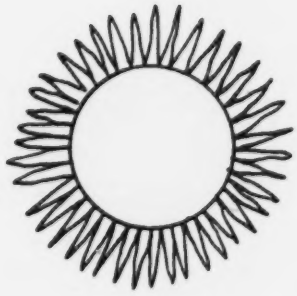
In situations where the home survey (Procedure, Step 6) seems impractical, use the school as an example instead. Take the class to the school heat source with the custodian. Talk about how the fuel gets to the school, how it is turned to heat, and how the heat gets from the heat source to the individual classrooms.

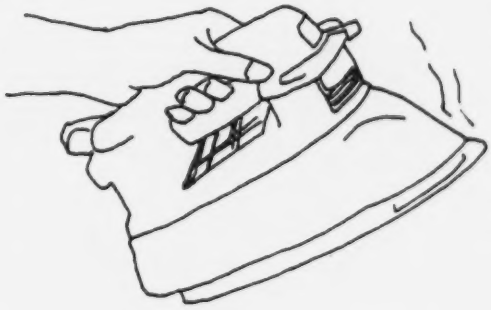
Show the class samples or pictures of coal, oil, firewood, solar collectors, etc.

Hot? or Cold?

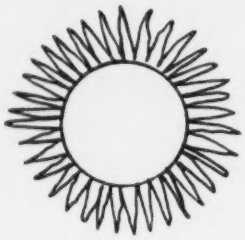




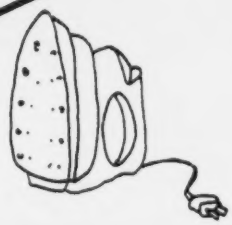




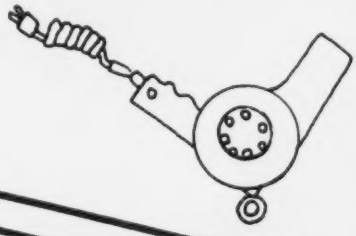
Where does heat come from?

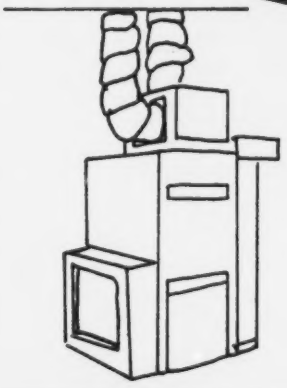


The Sun

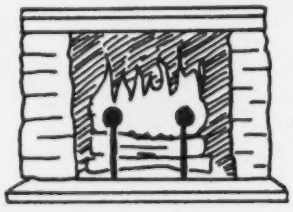


Electricity

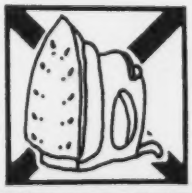




Burning Fuels

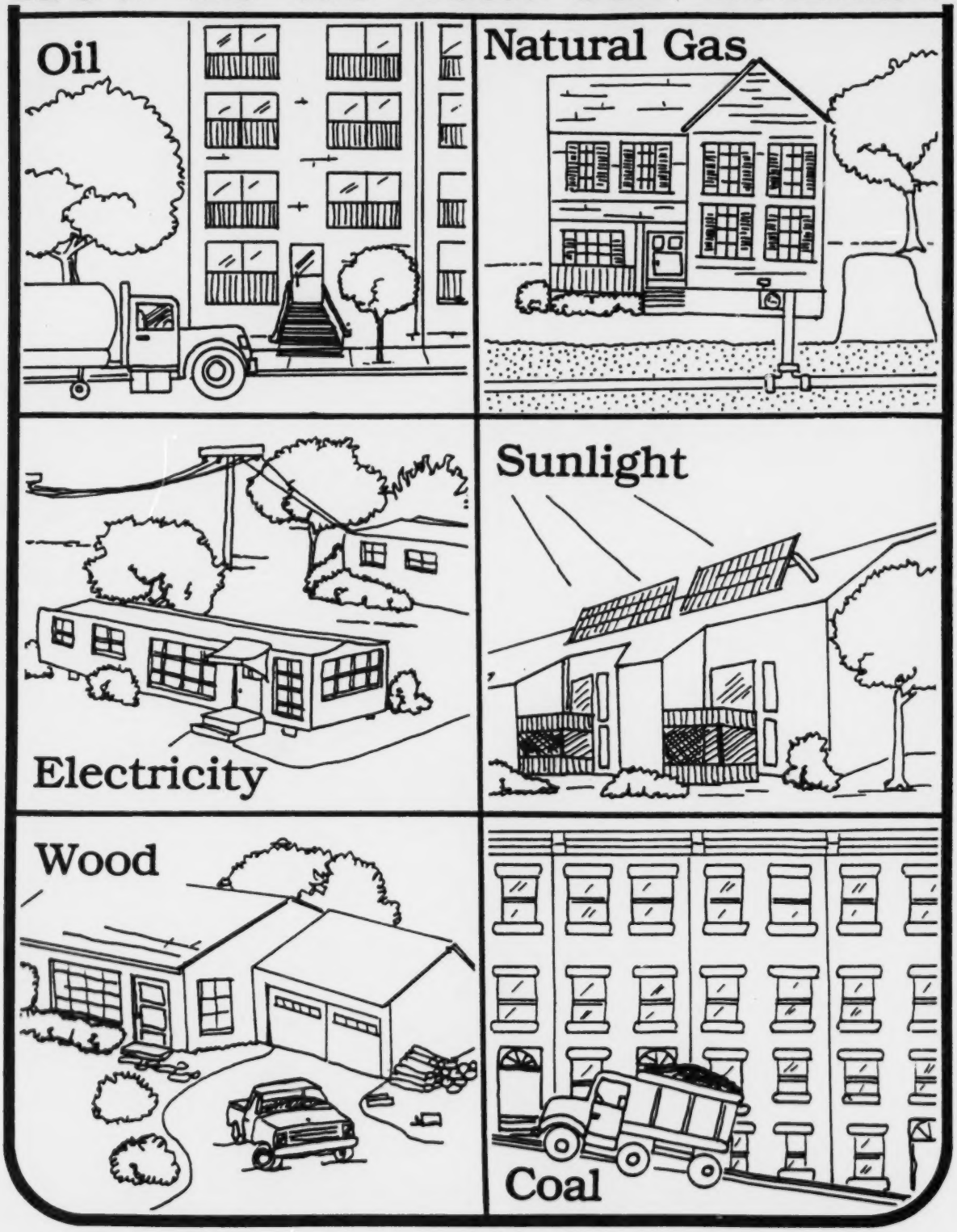


Be an energy safety watcher.



Things that heat can also burn.

How do we heat our homes?



7-5

To _____ Folks,

Whether we live in houses, apartments, condominiums or mobile homes, ENERGY HEATS OUR HOMES. You can help your child to understand this by helping him/her to fill out the survey below.

Please send it to school with your child tomorrow.

_____

Home Heating Survey

I live in a _____ house.
_____ apartment.
_____ mobile home.
_____ other. _____

My home gets its heat from _____ oil.
_____ coal.
_____ natural gas.
_____ electricity.
_____ wood.
_____ sunlight.
_____ other. _____

The energy to heat my home gets there_____ by truck.
_____ by pipeline.
_____ over wires.
_____ from the sun.

8. Question: What makes things move?

Purpose

To teach students that every form of transportation uses energy, and that wheels make it easier to transport things.

Introduction

Students will brainstorm means of transportation, and will carry out an experiment to see how wheels make transportation easier. They will connect means of transportation with the energy sources that power them.

Background

Transportation is one of the most important uses for energy in our society. As a society, we travel and move a lot, usually using fuels to get us where we're going.

Moving means overcoming inertia and friction. "Inertia" here means the tendency of something at rest to remain stationary. Energy must be applied to it to get it to move. "Friction" means the rubbing of particles against each other, which changes some of the energy of motion to heat energy. Anything that helps to reduce friction helps to save energy.

Understandings

The properties of an object can be changed by an event in which the object is involved.

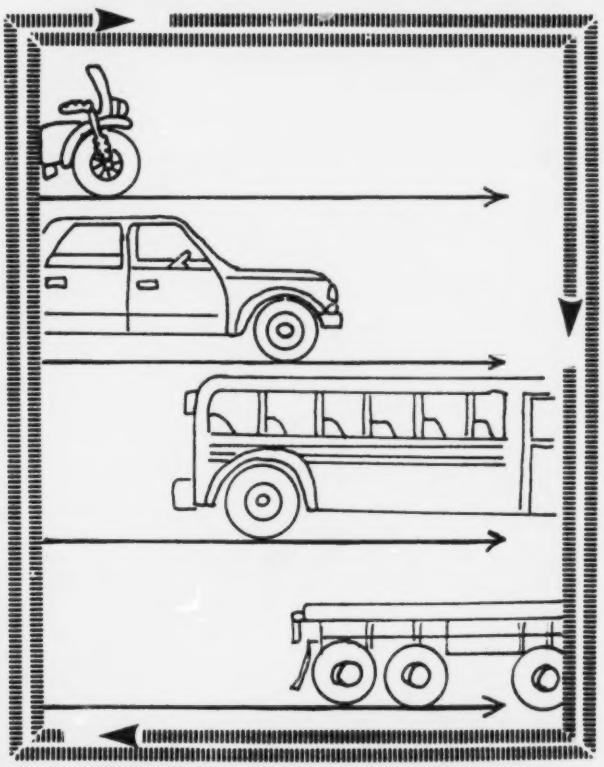
An object can be pushed or pulled to cause the object to change its motion.

Skills

Observing
Classifying
Creating models

Attitudes

Valuing the practical and technological.



Procedure

1. Ask: How do we get from one place to another? If you don't want to walk, what else can you do? How can you go very far, very fast? How many ways do we have for moving people?

   Show children your sheet of Ways to go . . . Ask what all of them can do. Give children their copies and ask them to draw in the empty box another thing that can be used for moving people or things.

2. Ask: How many of the things on the sheet have wheels? Why do they have wheels?

   Have children, working in small groups, fill a shoebox with weights --blocks, scissors, etc. Fasten a strong rubber band to one end. Let children try to pull it by the rubber band. Point out how the rubber band stretches and may almost break before the box moves.

Then line up a row of pencils side by side and put the box on them. Have children pull the rubber band and compare how easy it is to move the box.

Ask: Are the pencils like wheels? Do the pencils make it easier to move the box? Why?

3. Make paper airplanes with each child's name on his/her plane.

Ask: Will the airplanes go farther on the floor or in the air?

Try sliding the planes on a carpeted floor, a smooth floor, and then try flying them.

Ask: How far did your plane go on the carpet? How far did it go on the floor? How far did it go in the air? Was there a difference? Why?

4. Return to the Ways to go . . . sheet.

Ask: What makes the horse go? What makes the car go? etc.

Talk about how food and fuel provide the energy to make things go. Have children cut the sheet in half on the cutting line.

5. Distribute the What makes them go? sheet. Have children cut this sheet in half also.

Ask: Which pieces match? Can you match one horse picture with another horse picture? Can you match two bicycle pictures? Say: Put the matching pictures side by side.

Tape the matching strips together so that each student has two new pages, each one titled Ways to go... What makes them go? Have them draw pictures in the second empty box to complete the match. Ask different children to explain different pairs of pictures.

6. Use the Energy Safety Watcher sheet to remind children that traveling can be dangerous, and to review safety rules.

Materials

1. Ways to go... sheet, pencils
2. shoeboxes, weights, strong rubber bands, pencils
3. paper, stapler or paper clips
4. Ways to go... sheets, scissors
5. What makes them go? sheets, scissors, tape, pencils
6. Energy Safety Watcher sheet

Estimated Time for Activity

2.5 - 3 hours

Typical Results

Students enjoy experimenting with the boxes and paper planes, but may have difficulty matching the pictures and understanding why they go together. This must be spelled out in discussion.

Safety Notes

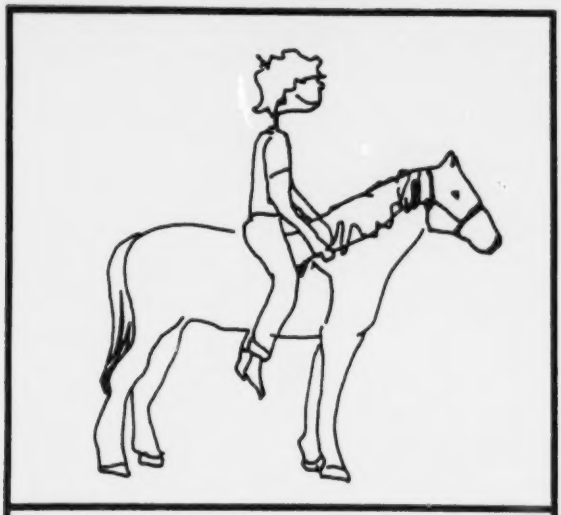
2. Make sure the rubber band is strong and flexible enough to stretch without breaking.
3. Don't allow students to throw planes at each other. It's best to have them all stand in a line, facing in the same direction.

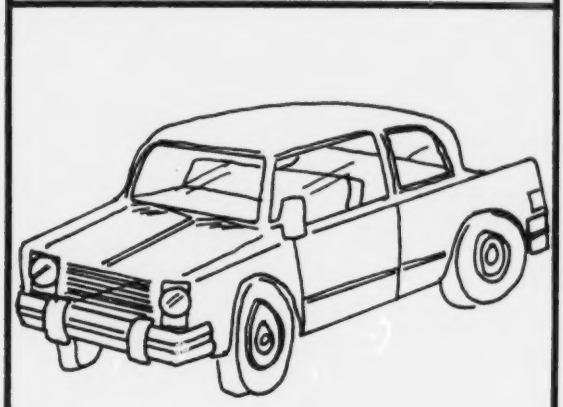
4&5. Supervise scissors work.

More Ideas

Experiment with more ways to make things go: sail-powered vehicles, rafts, and boats made from milk cartons; wind-up and battery-powered toys. Try pulling the box on different kinds of sliding surfaces and on rails, and measure the stretch of the rubber band. Use gravity to race vehicles on inclined planes and see whether size, weight, etc. are factors. Try different paper airplane designs to see which overcomes air resistance best.

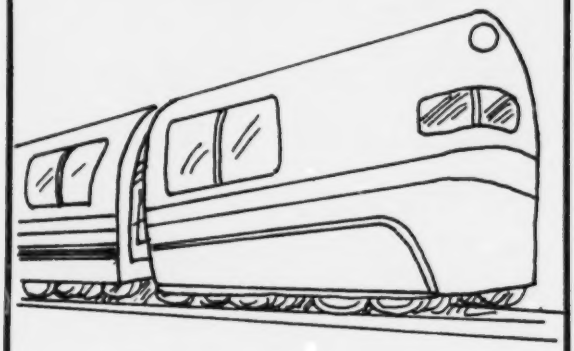
Ways to go . . .



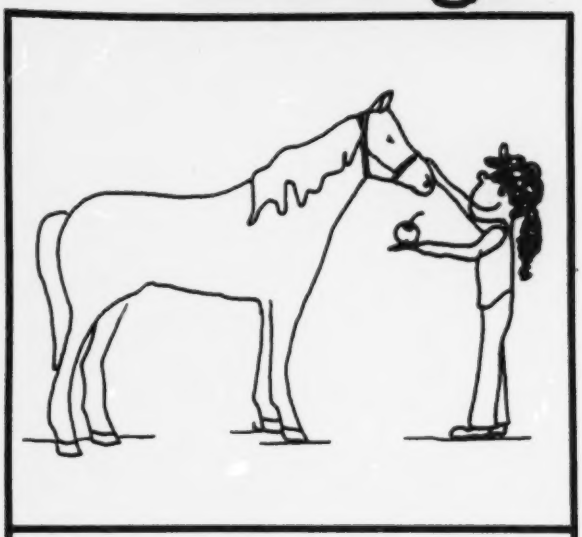


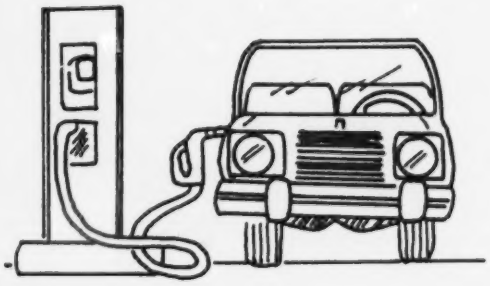
8-3

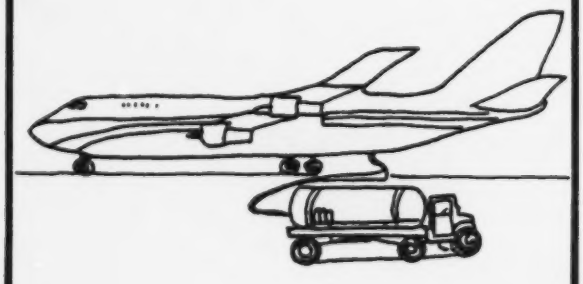
Ways to go . . .



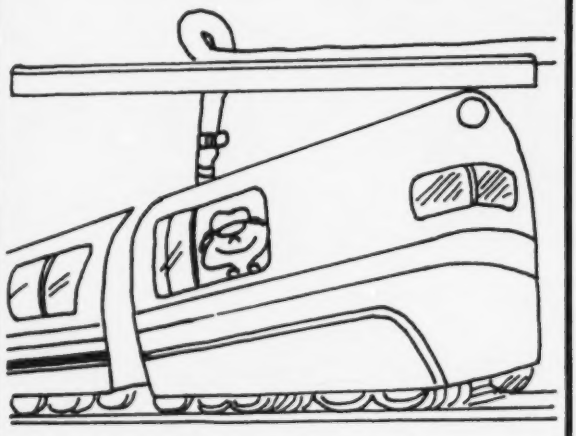
What makes them go?







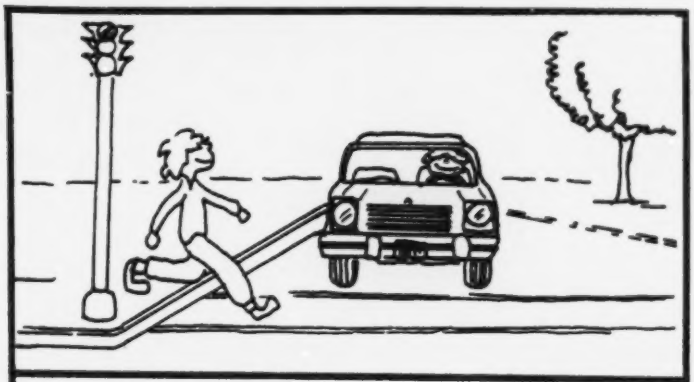
What makes them go?



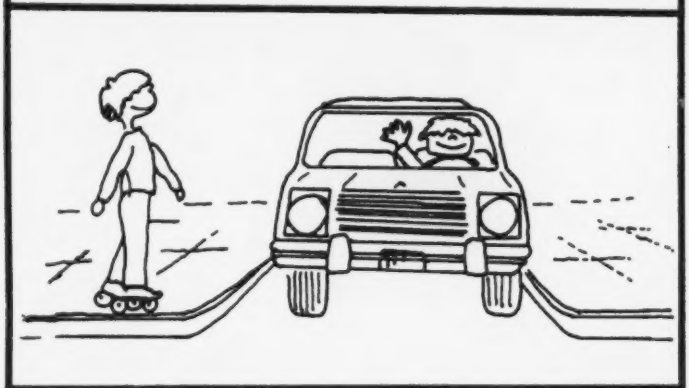
8-5

Be an energy safety watcher . . .

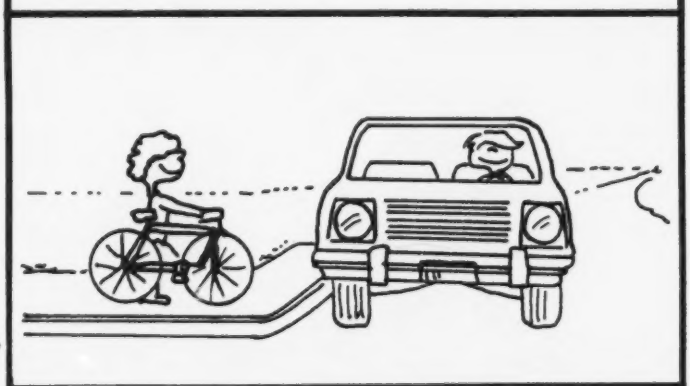
. . . when you walk.



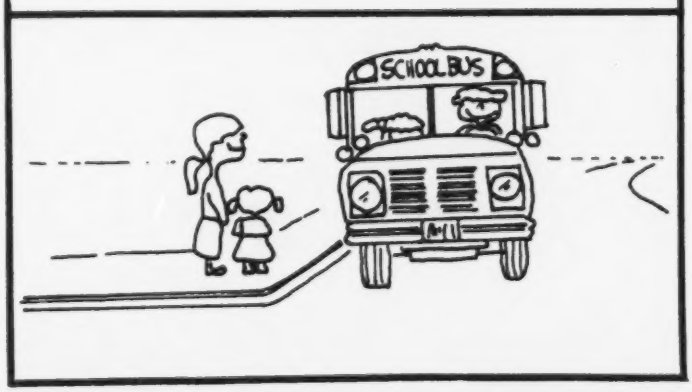
. . . when you skate.



. . . when you bicycle.



. . . when you ride the bus.



To _____ _____ Folks,

The class is learning about how ENERGY MOVES US FROM ONE PLACE TO ANOTHER. This would be a good time to remind your child of your safety rules for walking, skating, bicycling, and riding the bus.

_____

9. Question: Why do we need electricity?

Purpose

To show students how many conveniences and necessities rely on electricity.

Introduction

Students observe how appliances require electricity. They identify a number of appliances by where and how they are used. They then identify appliances in magazines and newspapers and make a montage.

Background

Since World War II the use of electrical power in the home and the workplace has grown astonishingly. Power tools, toys, and appliances have multiplied. Until the mid 1970's, consumption of electricity increased by about 7% a year. In other words, it doubled every 10 years.

In the late 1970's, this rate of growth dropped, but growth continued. We are still using more electricity every year.

Generally speaking, children of this age should not plug in or unplug appliances, or run them. Broken plugs, sparking outlets, frayed power cords, and shorts circuits all add to the normal hazards of appliances.

Understandings

Humans are able to control some conditions around them and meet their needs.

Objects have distinctive properties.

Skills

Observing
Classifying
Creating models
Developing vocabulary

Attitudes

Valuing the practical and technological.

Procedure

1. Show children 3 small appliances: one that lights, one that heats, and one that moves. (Could be a lamp, a blow dryer, and a phonograph.)

   Ask: What makes this go? Can I turn it on? If I turn it on, will it light up (or start blowing, or start turning.)

   Turn them on without plugging them in. Talk about why they don't work. Discover the need to plug them in. Do so, and turn them on again. Ask children what things they have at home that must be plugged in to make them work. Make a list of all the things they can think of.

2. Go over the Energy Users sheet, talking about each picture and asking children to identify the appliances by name. You may wish to write the name of each appliance on the board.

3. Introduce the House or Apartment Plan.

   Ask: What do people do in the kitchen? What do people do in the living room? Do you have a cellar where you can keep things? What do you keep there? Etc.

   Have children color, cut out, and glue the Energy Users pictures on the house plan to show where they think they should go. They may draw other appliances on the plan. Talk about what each thing does and why it is useful.

4. Collect old homemaking magazines, sales supplements from the Sunday newspapers, etc. Ask children to find pictures of all the things that use electricity. Clip these and make a montage or bulletin board. Talk about each picture.

   Ask: Does this use electricity? What does the electricity do? (Makes it hot, makes it move, etc.)

Materials

1. Three small electrical appliances, an electrical outlet
2. Energy Users sheets
3. House or Apartment Plan sheets, scissors, glue, crayons.
4. Old magazines, sales announcements, chain store catalogs, etc.; scissors; poster board or bulletin board; tape, glue, or staples.

Estimated Time for Activity

2.5 - 3 hours

Typical Results

Most appliances will be fairly familiar, but some may be completely unknown to some children. You may wish to try a "touching experience" where children feel an electric blanket heat up, see how an electric toothbrush works, etc., but remember to emphasize safety.

Safety Notes

1. Be sure appliance cords are in good condition, and that outlet doesn't spark. When finished with demonstration unplug appliances and store to avoid accidents.

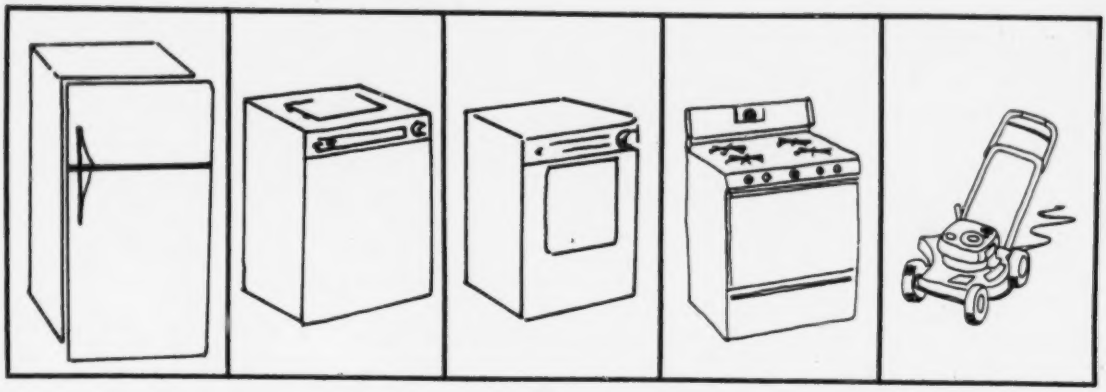
3&4. Supervise scissors work.

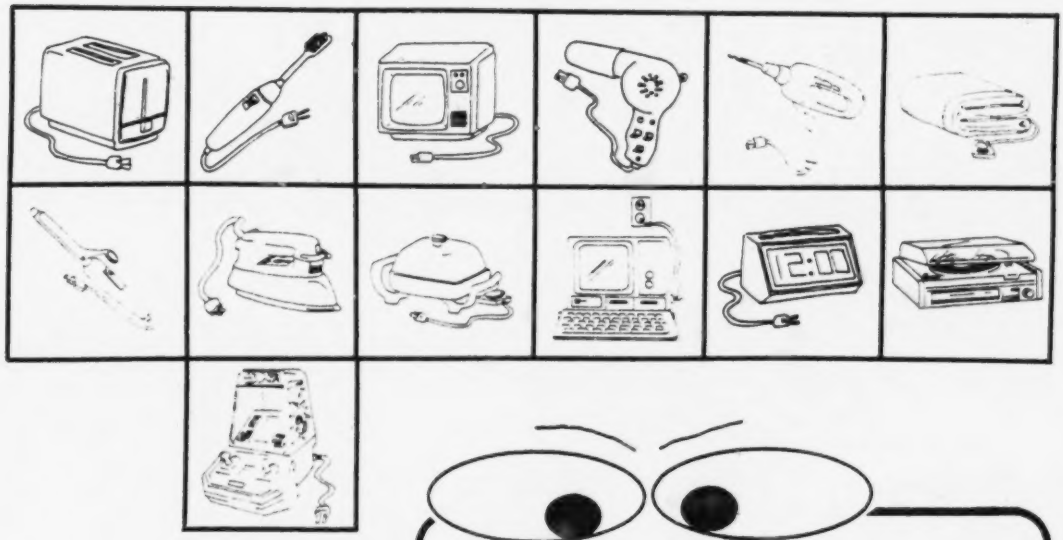
More Ideas

Count the things in the school (classrooms, offices, cafeteria) that use electricity.

Ask a utility company representative to come and talk to the children about electricity and safety.

Energy Users



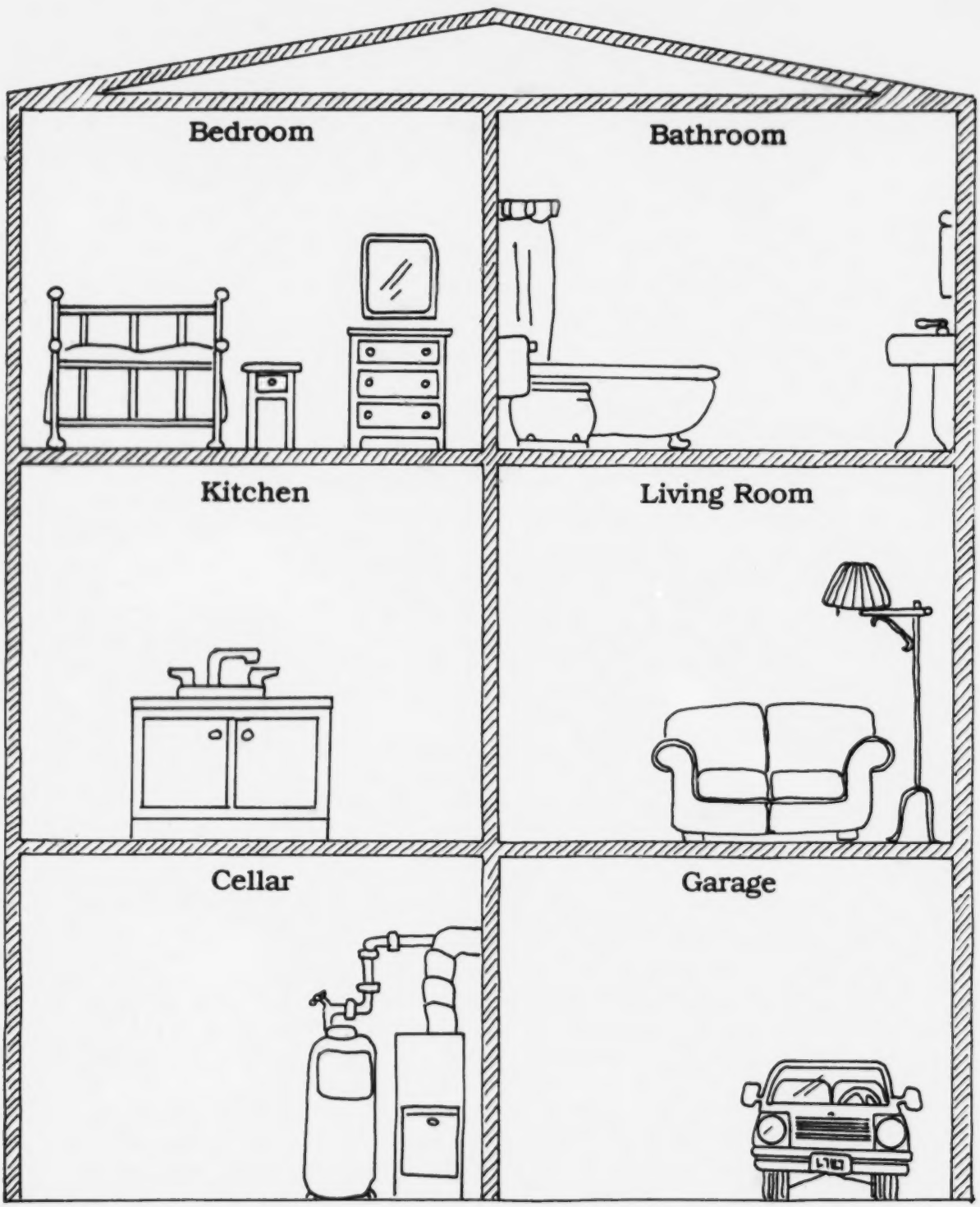


Be an energy safety watcher.

An appliance is not a toy.

Ask a grown up to help you.

House or Apartment Plan



To _____ Folks,

WHY DO WE NEED ELECTRICITY? The class is learning this week about many of the ways we use electricity at home.

This might be a good time to talk to your child about electricity and safety.

_____

10. Question: Why do we need energy?

Purpose

To focus student attention on the variety of energy sources and the many needs for energy in our lives.

Introduction

Students will learn the names and uses of several forms of energy, and make a gameboard with the names and pictures. They will then play Energy Bingo to reinforce what they've learned.

Background

Children use energy all the time, but are usually not aware of the term energy or of the sources of energy. Without forcing any memorization or deep understanding, this activity allows students to become more familiar with energy sources.

Some sources of energy, such as geothermal, biomass, and nuclear energy, are not explained in the game because of the students' level of comprehension. The source of electricity is also not explained, for the same reason. Although several of the sources of energy (oil, coal, natural gas) are also used to generate electricity, it is not necessary or appropriate to go into that at this level.

Understandings

Living objects live and thrive when their needs are met.

Humans are able to control some conditions around them and meet their needs.

Skills

Acquiring information and developing concepts through active reading and listening.

Classifying
Developing vocabulary
Using cues

Attitudes

Appreciating the natural world as an essential resource in fulfilling human needs.

Procedure

1. Give out the ENERGY BINGO PICTURE sheets. Beginning with those pictures most familiar to students, talk about each picture.

   Ask: What is this? What can it do? What can we use it for? Where does it come from?

   As you complete discussion of each picture, have children cut out and color that picture and glue it on any square of their BINGO GAME CARD, picture side up, print side down. (Different children should position their pictures differently, so game cards don't all come out the same.) Cut and color a set of pictures for yourself to use as flashcards in Step 3.

2. Have each child draw a safety picture in the Free Space in the center of the card. You may suggest a topic, or several topics. ►

3. Give each child 9 markers (bottle caps, poker chips, or squares of paper). Each child places one marker on the Free Space.

   Call out "I need something that..." and read the back of one card (without showing the picture). Let children guess and call out which picture it is. Show the picture and have them put a marker on the space.

   The object is to get a straight line of markers (horizontal, vertical, or diagonal). Declare 1st, 2nd, 3rd, etc. winners and then continue until all the spaces are full.

Materials

1. Energy Bingo Pictures sheets and Energy Bingo Game Card sheets, scissors, crayons, glue
2. completed Game Cards, crayons
3. completed Game Cards, 9 markers per child, teacher's flash cards

Estimated Time for Activity

2.5 – 3 hours

Typical Results

Students will have good comprehension of the sources of energy that are close to their own experience (food and electricity, for example).

Those that are more remote (water power, for example) may be harder to grasp. You may wish to reinforce with more pictures and examples, or simply gloss over the more difficult material and concentrate on the game.

Safety Notes

1. Supervise scissors work. You may wish to cut up the sheets yourself in advance, and distribute the cards one at a time as you discuss them.

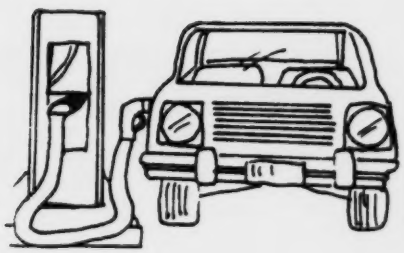
More Ideas

Cut magazine pictures for scrapbooks or bulletin boards that show people getting or using different sources of energy.

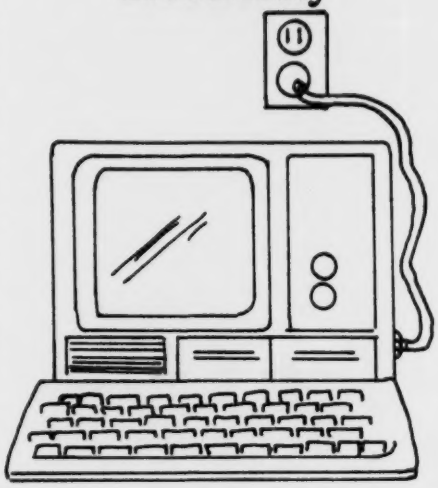
Arrange to take the class to watch the next time coal or oil is delivered to the school. Or take a walk and follow the school power lines for several blocks, to make children aware of how energy gets to where it is used.

Energy Bingo Picture

Oil

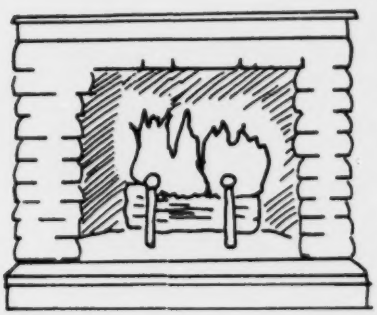


Electricity



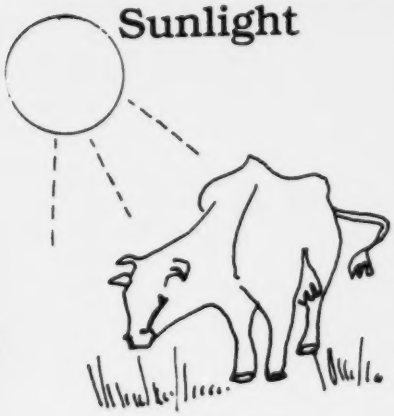
Food

Wood

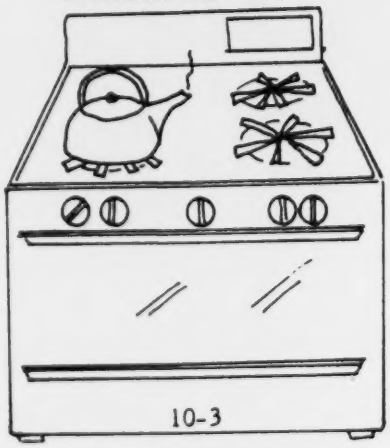


Coal

Sunlight



Natural Gas



10-3

Wind and Water

I need
something that comes
from the air and the
rivers and runs machines
to make electricity.

I need
something that comes
from the ground and makes
heat for factories and homes

I need
something that comes
from plants and animals
and helps me to live and
grow.

I need
something that comes
from the ground and can heat
my home or cook my food.

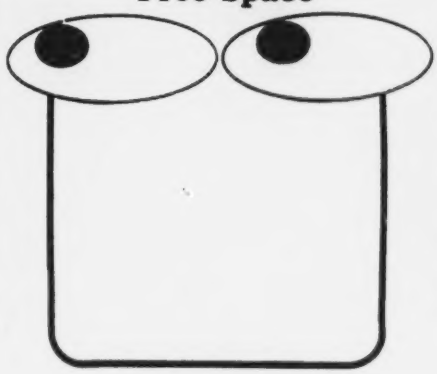
I need
something that comes
through wires or from batteries
and makes my toys and
appliances go.

I need
something that comes
from the sun and grows my
food and keeps me warm.

I need
something that comes
from trees and
gives me heat.

I need
something that comes
from the ground
and runs cars, trains,
and airplanes.

Energy Bingo Game Card

	Free Space  Be an energy safety watcher.	

To _____ Folks,

Sometimes we can learn a lot from games. Today the class played a game that taught that WE NEED ENERGY SOURCES IN ORDER TO LIVE. The game included information about sunlight, wind and water power, food, fuels like wood, oil, coal, and natural gas, and electricity.

You can help by reminding your child to turn off lights and faucets.

Everyone who learns more about energy is a winner!!

_____

11. Question: How can we save energy?

Purpose

To make students aware of a few specific ways in which they can save energy.

Introduction

Students will observe how insulation blocks heat flow, and will detect how heat escapes from buildings. They will identify common habits that waste home energy. Finally, they will experiment with different size vehicles and loads, and see how transportation efficiencies vary.

Background

We must use energy to live, and we will always use it. But we can use it in such a way that we save some of it, or in such a way that we waste some of it.

Children can help to save energy in residences and transportation. In residences, insulation and other materials help to block drafts and to slow heat loss. Students can learn to identify areas that need weather-stripping, caulk, or insulation. More care in turning off appliances and hot water can save energy and money all through students' lives. Awareness of energy consumption in transportation helps students to see that different forms of transportation are appropriate for different needs.

Understandings

Humans are able to control some conditions around them and meet their needs.

Humans move about and meet their needs.

Skills

Observing
Measuring
Creating models
Using numbers
Interpreting data

Attitudes

Appreciating the natural world as an essential resource in fulfilling human needs.

Draft Detector

Procedure

1. Talk about what kinds of energy we use to heat our homes.

   Ask: How do our homes keep the heat in and keep the cold out in the winter? Does cold get in and heat get out? How does this happen?

   Make draft detectors from pencils and tissue paper. Take children on a classroom or school hunt for drafts.

2. Fill two cups of about the same size with equal amounts of hot water. One should be tin, one styrofoam. Wrap the styrofoam cup in insulation (a dish towel, some newspaper, etc.) and put a lid on it. Set the two cups in the same area for ten minutes. Then let children "finger test" the water in each (or use thermometers).

Ask: Is there a difference? Did some of the heat go away? Where did it go? Is there some way that we could keep all the heat in?

3. Teach the Insulation Song.

4. Distribute the What's wrong with this picture? sheet. Ask children to identify what things seem "wrong", and which of those things waste energy.

   (Answer: refrigerator open,
   light on,
   TV on,
   water running, and
   no one is in the room!)

5. Take two boxes: one large (a cardboard carton), one smaller (a shoebox). Have children lift and push both boxes.

   Ask: Which box is easier to lift? Which box is easier to push? Is the big box heavier?

   Make a small pile of blocks.

   Say: I want to carry these blocks. Which box should I carry them in? Is it easier to carry them in the small box? Do I need a big box to carry these blocks?

   Make a big pile of blocks.

   Say: Now I want to carry all these blocks. Which box should I carry them in? Will they all fit in the small box? Do I need the big box?

   Fill both boxes with blocks. Have children lift and push both (or try to).

   Ask: Does it take more energy to move one of the boxes? Which one? Which box holds the most?

6. Distribute the Going Places sheet. Ask how children get to school. Compare different ways of getting to school to determine how much gasoline they use. Which uses the most per child? Point out that the boxes of blocks are like cars or buses. You need a big vehicle to carry a lot of people, but only a small vehicle to carry a few people.

   Ask: Which uses the most energy: a bus, a big car, a small car, or a bicycle? If I want to move 20 children, what should I use? Five children? Two? If I only want to go a short distance, what should I use?

Materials

1. pencils, tape, tissue paper
2. tin cup, styrofoam cup with lid, some kind of insulation, hot water
3. the Insulation Song sheets
4. What's wrong with this picture? sheet, pencils
5. large and small cardboard boxes, weights (blocks, books, etc.)
6. Going Places sheet

Estimated Time for Activity

3 to 4 hours over several days

Typical Results

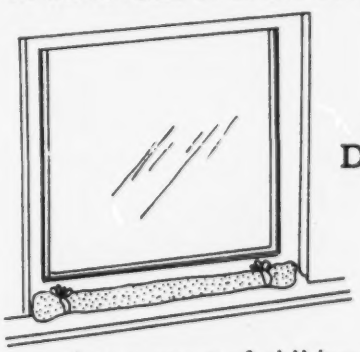
Children should have no difficulty with most of the procedures. If the math on the Going Places sheet presents difficulties, you may want to model each situation with stick figures and cups drawn on the board.

Safety Notes

1. Make sure hot water isn't scalding.

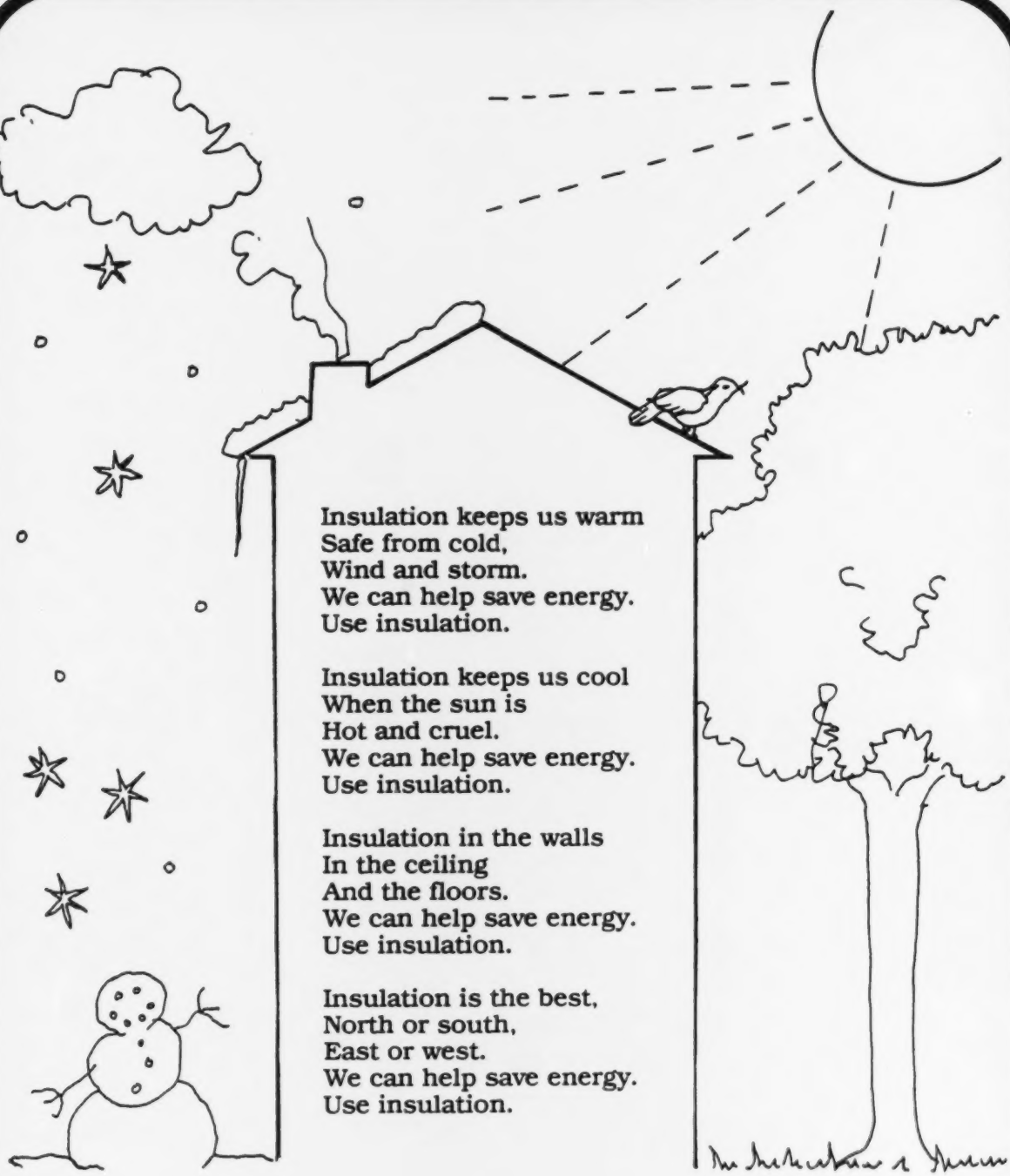
More Ideas

Make draft stoppers out of cloth tubes or tube socks, filled with kitty litter. Decorate with yarn and take home to block drafts on windowsills or at the bottoms of doors.



Draft Stopper

Let a group of children decorate the shoebox as a car and the cardboard box as a schoolbus, using felt pens. Windows (plastic wrap) and wheels (jar lids) can be added if you wish.



Insulation keeps us warm
Safe from cold,
Wind and storm.
We can help save energy.
Use insulation.

Insulation keeps us cool
When the sun is
Hot and cruel.
We can help save energy.
Use insulation.

Insulation in the walls
In the ceiling
And the floors.
We can help save energy.
Use insulation.

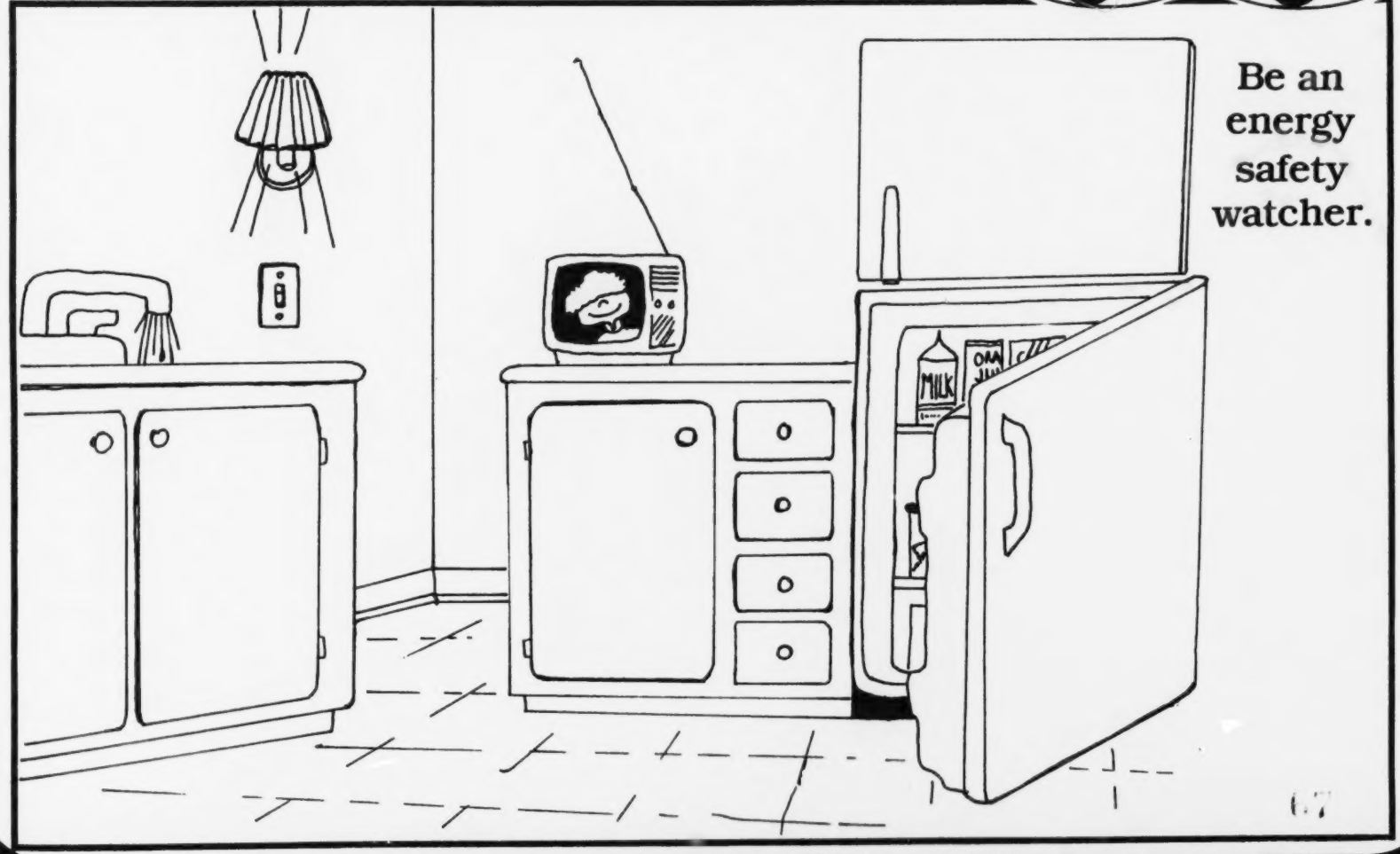
Insulation is the best,
North or south,
East or west.
We can help save energy.
Use insulation.

THE INSULATION SONG

(Tune of London Bridge)

What's wrong with this picture?

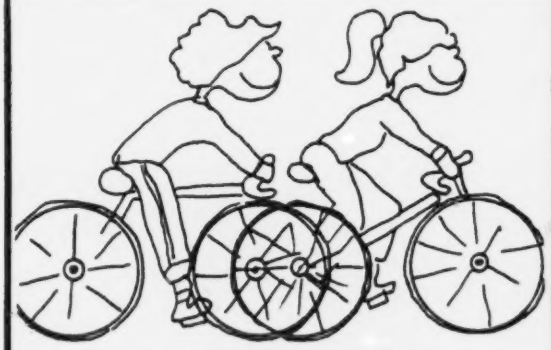
Make an X where you see energy being wasted.



11-4

Going Places

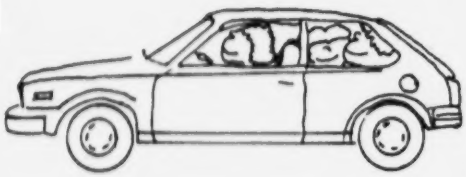
0 cups of gasoline
2 children



0 cups of gasoline
2 children

4 cups of gasoline
2 children

2 cups of gasoline
2 children



1 cup of gasoline
2 children

4 cups of gasoline
20 children

Which uses the most energy for each child?

To _____ Folks,

The class is learning that ENERGY IS VALUABLE AND SHOULDN'T BE WASTED. We can all save energy at home and when we travel. By doing this we help to control prices and ensure that there will be energy for our children's future.

_____

12. Question: How much do I know about energy?

Purpose

To help students review what they have learned about energy, energy conservation, and energy safety.

Introduction

Students answer questions that summarize their knowledge of energy. They then make a mobile consisting of pictures, objects, and "Save and Be Safe" reminders.

Background

Energy conservation and energy safety are often linked.

For example, speeding wastes energy and endangers lives. A well-insulated building saves energy and is a healthier place in which to live. Leaving appliances running unattended wastes energy and is a safety hazard.

Children enjoy being helpful. Training them in observation skills and energy consciousness allows them to help prevent waste and accidents. This activity summarizes what they have learned, and emphasizes conservation and safety.

Understandings

Living objects, including plants and animals, live and thrive when their needs are met.

Humans are able to control some conditions around them and meet their needs.

Skills

Communicating information
Developing vocabulary
Creating models

Attitudes

Wanting to know about and understand the natural world.

Respecting others and the environment.

Procedure

In this activity a series of questions is used to elicit a summary of the children's knowledge of energy. Use observations of their surroundings to remind them of previous learnings. List their responses on the chalkboard.

1. How much do we know about energy?

   Ask: What makes our bodies able to move and grow? Where do we get the heat for our homes and for the school?

   What makes vehicles move? What runs our toys and appliances?

2. What wastes energy and how can we save it?

   Ask: Do we waste food? How? How could we save it? When we heat our homes, does that heat get lost sometimes? How does that happen? How could we keep it from happening? Do we waste electricity sometimes? How does that happen? How could we save electricity? What makes cars and buses ►

and trains go? Does that get wasted sometimes? How could we save gas? Why does littering waste energy?

3. Can energy be dangerous? What must we do to use it safely?

   Ask: What does dangerous mean? What does it mean to use something safely? What could be dangerous about energy? Is heat dangerous? - the sun, fire, fuel, heaters? How can we use heat sources safely? Is electricity dangerous? How can we use it safely? Is traveling dangerous? How can we travel safely? Why is littering dangerous?

4. Make energy safety mobiles. Color and cut out the Energy Sources and Energy Uses pictures. Discuss each picture and what it means as children color it. (The matching shapes are related pictures and can be glued back to back.) Hang pictures with yarn from coat hangers. Write favorite Save and be safe reminders on shapes cut from construction paper. Decorate and hang them from the mobiles. Add small objects that remind children of things they have learned: a battery, a toy car or plane, popcorn strings, a magnet, a pinwheel, etc.

Materials

4. Energy Sources/Energy Uses sheets, Save and be safe reminders, construction paper, scissors, crayons, felt pens, glue, yarn, coat hangers, "found objects"

Estimated Time for Activity

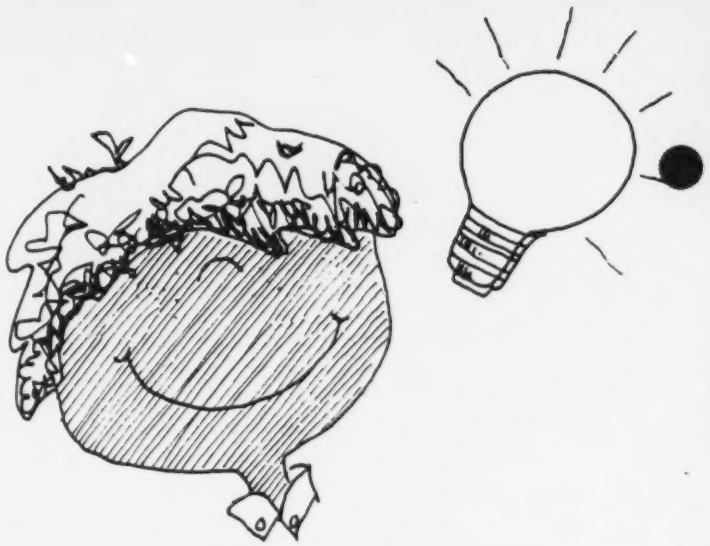
2 hours

Typical Results

Although children may not understand "energy" as a concept, they will now be able to connect some sources of energy to their uses. Conservation and safety will be best understood if they are taught as specific Do's and Don'ts, concrete behaviors that the child can practice.

Safety Notes

In the discussion of danger and safety, emphasize that energy can be dangerous because you can't always see the danger.



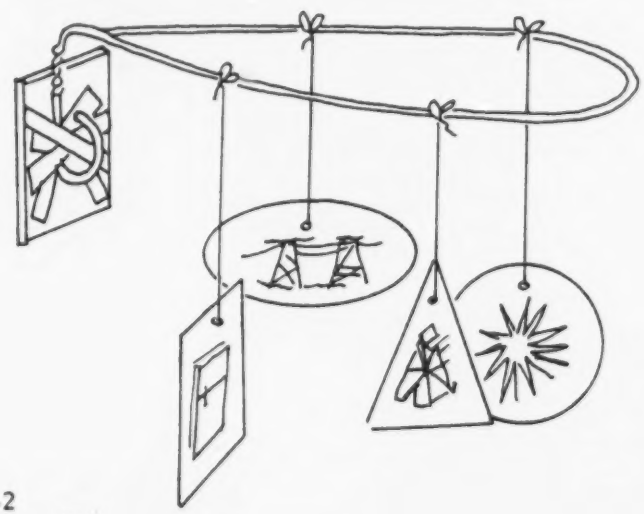
Heat, electricity, moving vehicles, litter are often dangerous precisely because we don't perceive that they are present until the accident has happened. Hence the emphasis on being an "Energy Safety Watcher."

More Ideas

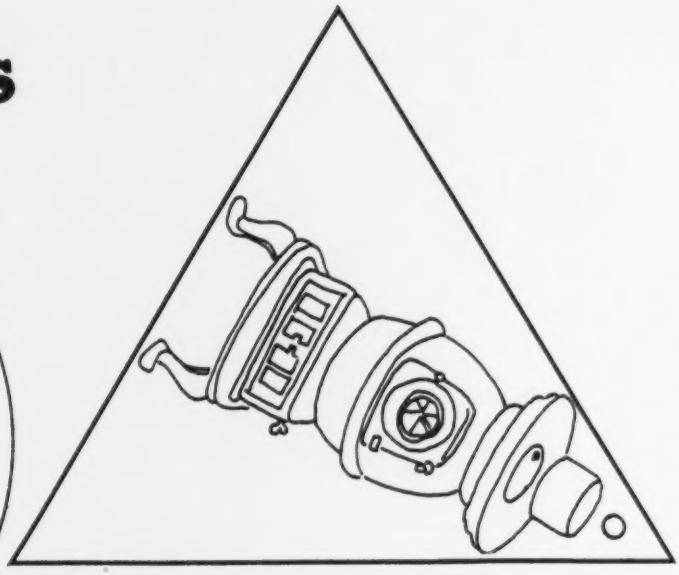
Make Save and be safe reminder stickers to attach to the refrigerator door, the car dashboard, the bathroom mirror, TV, light switch plate, etc.

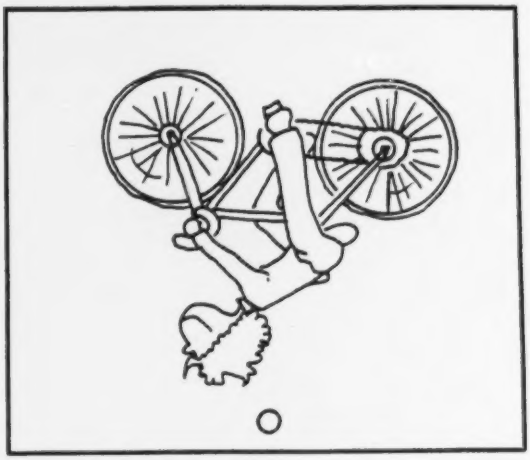
Appoint a "save and be safe" class monitor each week to turn off lights, pull down shades, and help clean up litter at the end of the day.

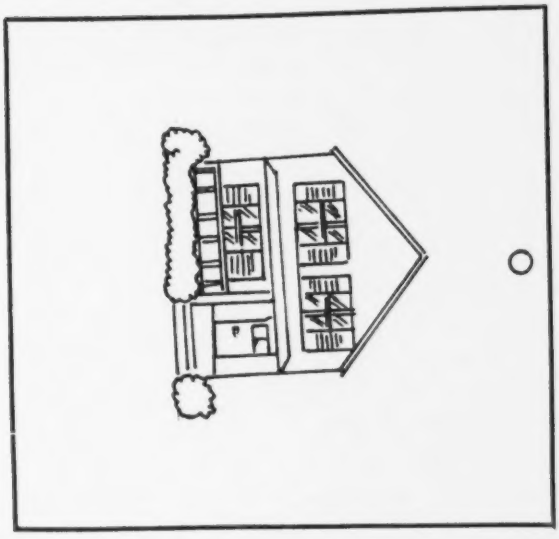
Give an energy play with children acting out the various sources of energy and what they are used for. Conservation and safety reminders and the energy songs can be incorporated.

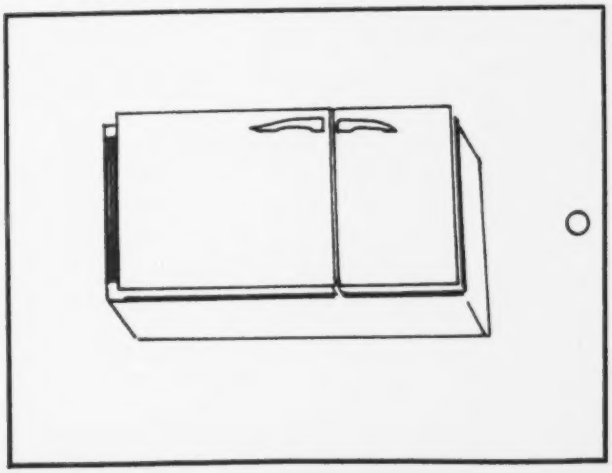


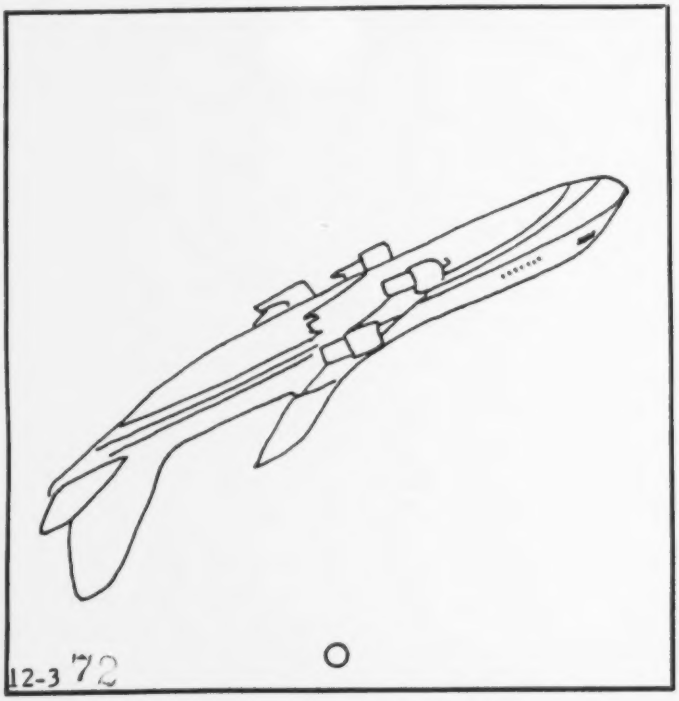
Energy Uses



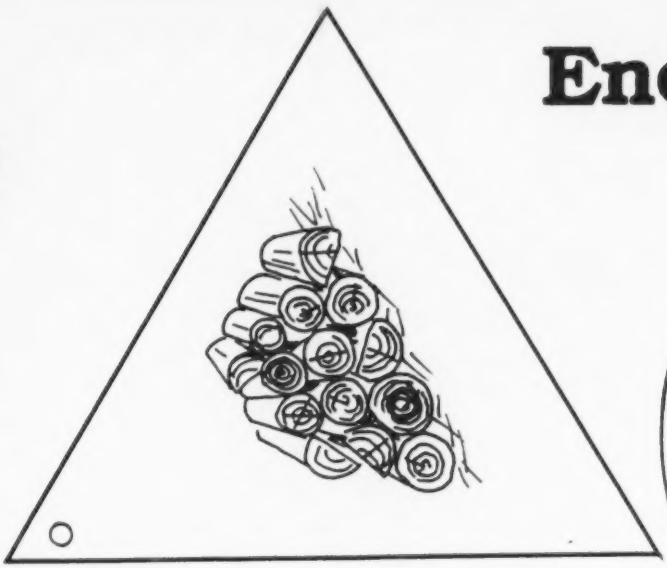


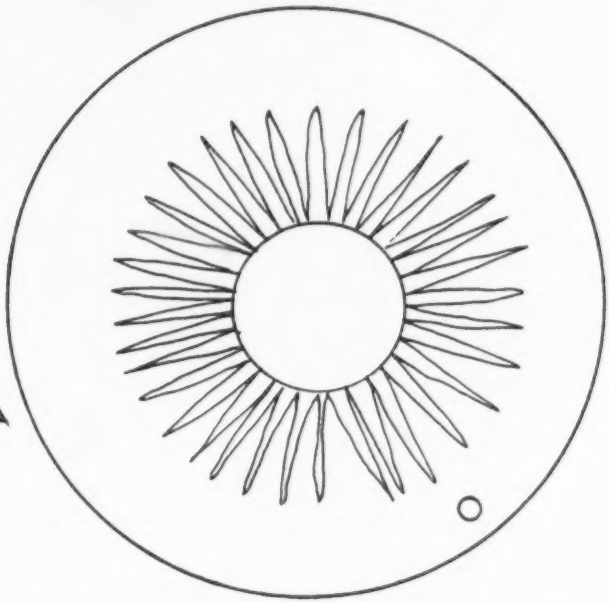


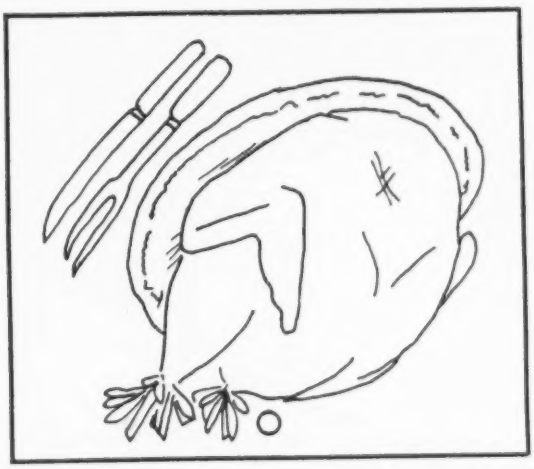


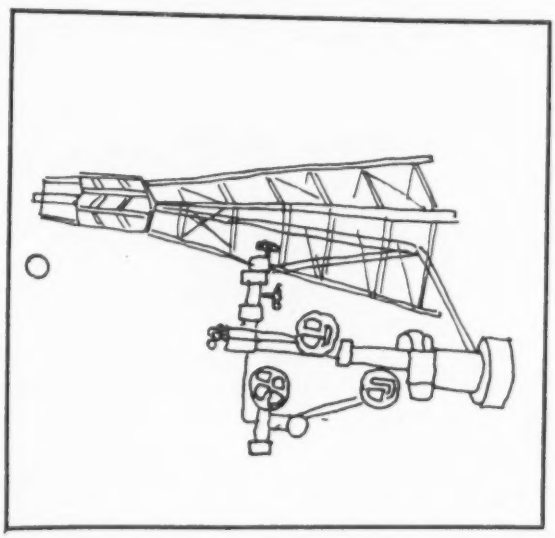


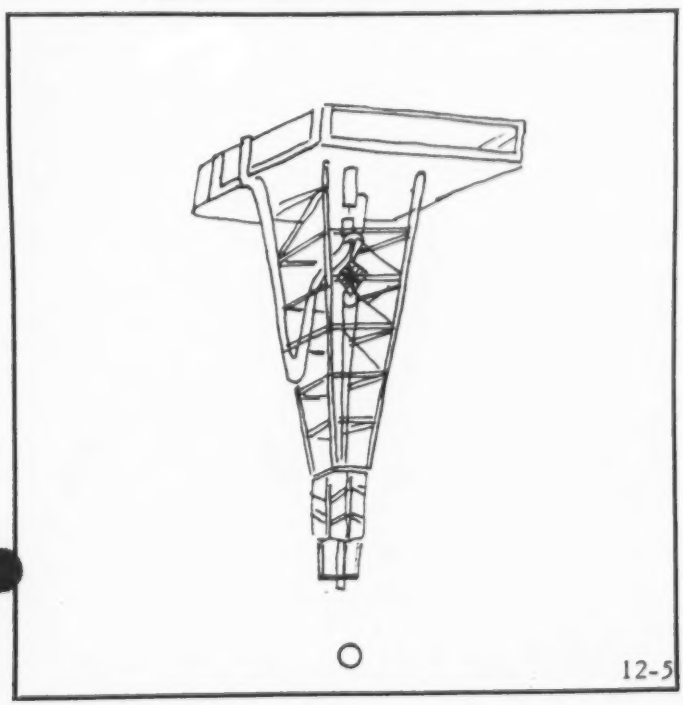
Energy Sources

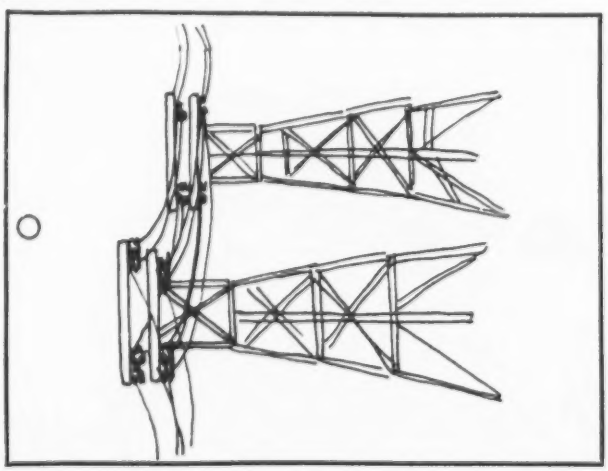












Be an energy safety watcher . . .

. . . with your health.

Eat a good breakfast.
Watch out for too much sun.
Don't play with fire or fuels.
Wear a sweater and keep the house cool.

. . . with your home.

Keep out the cold. Close the door.
Pull down the shades on cold nights.
Beware of heaters. They can burn.
Don't touch things that are cooking.
Keep in the cold. Close the refrigerator.
Don't leave the water running.

. . . when you travel

Be careful on the bus.
Walk, skate, and bike safely.
Drive 55 to save and be safe.

. . . with electricity.

Stay away from electrical towers.
Don't play with electrical outlets.
Keep appliances away from water.
Turn off the TV, radio, and stereo if no one is listening to them.
Turn off lights when you leave the room.

. . . with your world.

Don't be a litterbug.
Recycle cans and bottles.
Clean up litter.

Save and be safe.

To _____ Folks,

In our last energy lesson, we talked about how ENERGY SHOULD BE SAVED AND USED SAFELY. Because energy is powerful it can also be dangerous. Your child has learned a lot about energy, and knows that with energy, safety is important.

_____

Glossary

a

acid: a sour tasting substance that can break down other materials, and that turns blue litmus paper red. Most acid found in rain and snow is caused by burning fossil fuels.

acid deposition: the depositing of acid in the environment in snow, hail, sleet, fog, dew, frost, or dry sediment. The acid is the result of air pollution.

air: the mixture of gases that surrounds the earth. Air is odorless, tasteless, and colorless. It contains oxygen and carbon dioxide, which are used by living things.

alcohol fuel: fuel made by distilling grain, wood, or other plant products into alcohol.

alkaline battery: a dry cell battery that uses a highly alkaline (basic) electrolyte and gives a high charge for a relatively long period of time.

ampere: the unit of measurement of the rate of flow of an electric current (number of electrons/second).

appliances: machines, especially household machines, that use energy (usually electricity) to do work.

armature: a part of an electric motor or generator that revolves between the poles of a magnet (or within which a magnet revolves). It is made of wire wound around an iron core.

b

base: a substance that feels soapy when mixed with water, and that turns red litmus paper blue (also called alkali).

battery: a container holding wet or dry electrolytes that produce electricity.

biomass: an amount or volume of plant material in any form: algae, wood, crop residue, animal manure, etc. Biomass contains energy stored in chemical form.

c

caulking: a soft material that can be squeezed into the cracks of a building, to reduce the flow of air into and out of the building.

chemical energy: the energy released when substances combine or break down and form new substances.

chemical reaction: the combining or breaking down of substances to form new substances. Energy is used or given off in the reaction.

circuit: an arrangement of wires, tubes, etc., through which electricity flows.

clouds: masses of tiny drops of water or ice particles floating in the air high above the earth.

coal: a fossil fuel; a black rock composed mostly of carbon, formed under the earth's surface over millions of years from the remains of plants. Used as a fuel because it burns easily, coal causes air pollution when burned. It is a non-renewable energy source due to the conditions and time necessary to form it.

cold: having little heat energy.

conduction: the process by which heat or electrical energy travels through substances.

convection: the process by which heat energy travels in currents of air, water, or other fluids.

current: flow of electricity through a wire. The rate of flow is measured in amperes.

d

dam: a wall built to hold back flowing water. A dam may be part of a hydropowered generating plant.

decay: to rot or become rotten; to break down.

decomposition: rotting and breaking down of substances into what they are made of.

distance: the space between objects, or the space an object travels in a certain length of time.

distribution lines: heavy-duty wires that are used to distribute electricity from substations to nearby energy customers.

dry cell battery: a battery with the electrolyte in a paste form to reduce the risk of leaks.

e

electric current: a flow of electricity through a wire that can be measured, and is used to operate appliances, lights, etc.

electrical system (car): the system of devices and wires that produces and distributes electrical energy in a motor vehicle. Includes an electrical generator and a storage battery.

electricity: a form of energy that can produce light, heat, motion, and magnetic force. Electricity is a flow of electrons that can be produced by generators, friction, or chemical change in a battery.

electrolyte: a chemical (compound) which when dissolved in water will conduct an electrical current.

energy: the ability to do work. Light, heat, electricity, and gravity are some forms of energy.

engine (car): a machine that burns fuel to convert its chemical energy into mechanical energy.

exhaust system (car): a series of connected pipes that helps remove the waste products of an automobile engine.

f

force: any push or pull on an object.

fossil fuels: non-renewable energy sources (coal, petroleum, and natural gas) that must be mined or pumped from the ground and then burned to release their energy. A large share of our energy comes from fossil fuels; however, mining and burning them cause pollution and damage the earth's surface. These fuels are formed from the fossilized remains of plants and animals that have been buried for millions of years.

friction: a rubbing of one thing against another. The force that results when two moving objects are in contact with each other.

fuel: something that can be burned or broken down to produce heat energy.

fuse box: a small metal box connected to the main electrical circuit in a building. It contains fuses which are small metal strips inserted into an electrical circuit that melt and break the connection when the current becomes too strong.

g

gas turbine: a turbine that produces electricity by using the force of hot, expanding gases to make it revolve. The gases are produced by burning a fuel.

generator: a machine that changes energy of motion (mechanical) into electrical energy. It consists of a magnet and a coil of wire.

geothermal energy: the heat energy in the rocks, hot water, and steam in the earth's crust.

h

head (water power): the height that water from behind a dams falls to reach the turbine.

heat: the energy given off when the molecules of a substance move.

home: a place where a person or family lives. A home may be an apartment, a house, a mobile home, etc.

hot: having much heat energy.

hydropowered generating plant: a building or dam that contains machines that use the energy from falling water to make electricity.

i

ice: water made solid by cold; frozen water.

insulation: a material that slows heat loss or waste. Fiberglass, cellulose, rockwool, and styrofoam are examples.

j

joule: a metric unit of energy, equal to the energy used in one second by an electric current of one ampere, with a resistance of one ohm.

k

kilowatt: a measure of electric power, equal to 1000 watts, or to energy consumption at a rate of 1000 joules per second.

kilowatt hour: amount of energy equal to one kilowatt of power being used for one hour.

l

light: a form of energy that animals use to see and that plants use to make food. When light is absorbed by objects they heat up.

m

magnet: a piece of metal that has the ability to attract iron or steel with magnetic force.

mass: the amount of matter in a substance.

mechanical energy: energy due to the motion of an object. For example: the energy of th moving parts of an automobile engine.

meter: a device that measures the amount of natural gas, water, or electricity that is bein used.

methane: a colorless gas that burns easily. It forms from the decomposition of once livin materials, or can be made from petroleum. Natural gas contains methane.

motion: moving, or movement from one place to another.

n

natural gas: a fossil fuel; a colorless gas containing methane that formed over millions o years from the remains of plants and animals. It must be pumped from the earth, and i used as a heat fuel because it burns easily and cleanly. Natural gas is a non-renewabl energy source due to the conditions necessary to form it.

neutral: neither acid or basic, does not react.

nickel-cadium rechargeable battery: a dry cell battery with an alkaline (basic) electrolyte; type of storage battery.

non-renewable energy sources: sources of energy that are in limited supply, and take millio of years to replace. For example: oil, coal, natural gas, uranium.

nuclear fuel: an energy source made from materials that must be mined from the ground ar processed to obtain the radioactive elements. It is used as fuel in a nuclear reactor produce electricity. Some nuclear fuels can be made by reprocessing other nuclear fu after it is used.

o

oil: a fossil fuel; a thick, black liquid that is lighter than water, burns easily, and was form over millions of years from the remains of plants and animals. It must be pumped fro the earth and separated into products such as gasoline, kerosene, lubricants, plastic etc. Oil causes air pollution when burned, and is a non-renewable energy source due the conditions and time necessary to form it.

outlets: small openings in a wall where electrical plugs can be inserted to connect with wir that carry electricity.

p

penstock: a large pipe that carries water to a turbine in a hydroelectric plant.

pH: a measure of how acidic or basic a substance is. The pH scale goes from 0 to 14 with being neutral, below 7 increasingly acidic, and above 7 increasingly basic.

pH paper: white paper saturated with litmus, used to indicate the pH of substances changing color.

photosynthesis: the process by which green plants use sunlight to make food.

pipeline: a line of connected pipes used for carrying liquids or natural gas.

plants: any living things that are not animals. Plants are unable to move by themselves and lack a nervous system and sense organs. Green plants manufacture their own food.

q,r

rain: water falling to earth in drops from clouds.

recycle: to recover something so that it may be used again.

renewable energy sources: sources of energy that can be replenished in a short time, that are never really used up. For example: energy from the sun, wind, falling water, growing plants.

reservoir: a place where water is collected and stored for future use.

s

save: to keep from being used up or wasted.

snow: water vapor frozen into crystals that fall to earth in soft, white flakes.

soil: tiny particles of inorganic (rocks, minerals) and organic (decayed plants, animals) materials necessary for support and nourishment of plants.

sound: energy in the form of vibrations that travel through air, solids, and liquids, and produce "sounds" in the ear.

soundwaves: sound energy that travels through the air as a wave, at 1087 feet or 331 meters per second.

steam: the vapor that is given off when water is heated to the boiling point. Steam is a source of heat energy.

steam powered generating plant: a building that contains machines that make heat or electricity from steam. The steam is produced by burning coal, oil, natural gas, or garbage, or by using nuclear fuel, to boil water.

steam turbine: a turbine that produces electricity by using the force of steam to make it revolve.

storage battery: a battery that may be recharged after use.

substation: a building that has machines that help divide and regulate the flow of electricity from place to place.

sun: the star around which the earth and other planets revolve. The sun supplies the planets with light and heat.

sunlight: the light energy given off by the sun, which can be collected and used as a source of heat.

sun's energy: made up mostly of heat and light produced by the sun; known as solar energy. It can be collected and used to heat buildings and water, to produce electrical energy, and for lighting.

sustained: kept going.

t

temperature: a measure of heat or cold; a measure of the amount of energy in something.

thermometer: an instrument that measures heat energy.

thermostat: a device for sensing temperature; used to turn heating and cooling machines on and off at certain temperatures.

toxic substances: substances that are harmful to living things. These substances may also be useful products or byproducts of industry, energy production, etc.

transmission (car): the part of a motor vehicle that sends power from the engine to the axle(s) that turn the wheels.

transmission lines: heavy-duty wires that are used to carry electricity from one place to another, for example, from a generating plant to substations.

turbine: a device consisting of a wheel with blades that uses the force of water, wind, steam, or other hot gases to revolve it. A turbine is used to turn a generator to produce electricity.

u

utility company: a company that provides energy for people to use; sometimes owned by the public and sometimes by stockholders.

v

vapor: water in the air in the form of a gas.

vibrate: to move back and forth rapidly.

voicebox: the part of the throat that vibrates and produces the sounds of speech.

volt: the unit of measurement of the force needed to move electricity through a wire.

w

waste: to make poor use of, to use up without thought.

water: the most common liquid on earth, that falls from the sky as rain and forms rivers, oceans, etc. Pure water is colorless, tasteless, and odorless. Made up of hydrogen and oxygen.

water cycle: the process in which the sun evaporates water from the earth's surface, and the water is returned to the earth's surface in the form of precipitation from the atmosphere.

water power: energy (usually electricity) that is made from falling or running water.

water turbine: a turbine that uses the force of falling water to produce electricity.

water vapor: water in the form of a vapor.

watt: a unit of measurement of the amount of work done by an electric current per second (power).

weatherstripping: a material that is applied around doors and windows to reduce the flow of air.

wet cell battery: a battery with a liquid electrolyte.

wind: air in motion, caused by differences in the temperature and pressure of air masses.

windmill: a machine powered by the force of the wind on a wheel with vanes or sails, mounted on a tower; used to pump water, grind grain, generate electricity, etc.

wind-powered electric generator: an electric generator that is powered by a windmill or wind turbine.

wind turbine: a turbine that uses the force of the wind to produce electricity.

wood: a hard substance found beneath the bark of trees and shrubs. Wood is used as a fuel because it burns easily. It causes air pollution when burned. Wood is a renewable energy source because trees and shrubs can be replenished in a few years.

work: the use of the force of energy to move something a certain distance.

x,y,z

zinc-carbon battery: a standard dry-cell battery, which uses an acid for the electrolyte. It is not rechargeable.

Resources

Level I

I, 1. Everything Moves, by Seymour Simon
(New York: Walker and Company, 1976)

Popcorn Dragon, by Jane Thayer
(New York: William Morrow & Co., Inc., 1953)

Sometimes Things Change, by Patricia Eastman
(Chicago: Children's Press, 1983)

I, 2. Gravity All Around, by Tillie S. Pine and Joseph Levine
(New York: McGraw Hill Book Company, Inc., 1963)

Please, Wind?, by Carol Greene
(Chicago: Children's Press, 1982)

I, 3. The Cloud Book, by Tomie de Paola
(New York: Holiday House, 1975)

The Day We Saw the Sun Come Up, by Alice E. Goudey
(New York: Charles Scribner's Sons, 1961)

Rain and Hail, by Franklyn M. Branley
(New York: Thomas Y. Crowell Company, 1963)

Science Experiences: Solids, Liquids, and Gases, by Jeanne Bendick
(New York: Franklin Watts, Inc., 1984)

I, 4. Rusty Rings a Bell, by Franklyn M. Branley
(New York: Thomas Y. Crowell Company)

I, 5. Energy from the Sun, by Melvin Berger
(New York: Thomas Y. Crowell Company, 1976)

Roots Are Food Finders, by Franklyn Branley
(New York: Thomas Y. Crowell Company, 1975)

I, 6. Energy, Food, and You, (elementary booklet)
(Washington State Office of Environmental Education, c/o Shoreline School District Administration Building, NE 158th and 20th Ave., NE, Seattle, WA 98155)

What Happens to a Hamburger, by Paul Showers
(New York: Thomas Y. Crowell, Company, 1970)

I, 7. Heat, by Vicki Cobb
(New York: Franklin Watts, Inc., 1973)

Hot and Cold, by Irving Adler
(New York: Harper & Row, John Day Junior Books, 1975)

I, 8. How We Move Things (filmstrip)
(Popular Science Publishing Company, 1962)

I, 9. Arthur's New Power, by Russell Hoban
(New York: Thomas Y. Crowell Company, 1978)

Blackout, by Anne and Harlow Rockwell
(New York: Macmillan Publishing Company, Inc., 1979)

Play It Safe -- Away from Electricity
(South Deerfield, MA: Channing L. Bete Co., Inc., 1977)

I, 10. Energy from the Sun, by Melvin Berger
(New York: Thomas Y. Crowell Company, 1976)

I, 11. More Power to You: An Energy Conservation Puppet Show
(The Peppermint Playhouse Puppeteers, 620 Red Oak Drive, River Vale, NJ 07675. Telephone: 201-666-2275)

I, 12. The Berenstain Bears' Science Fair, by Stan and Jan Berenstain
(New York: Random House, Inc., 1977)

Energy Mobile (kit of cut-outs and teachers' guide)
(NYS Energy Office, Office of Communications, 2 Rockefeller Plaza, Albany, NY 12223)

Level II

II, 1. Wind, (10 minute color film)
(National Film Board of Canada, 1973)

Energy All Around Us, by Tillie S. Pine and Joseph Levine
(New York: McGraw-Hill Book Co., 1975)

Energy at Work, by John Satchwell
(New York: Lothrop, Lee and Shepard Books, 1981)

Energy Does Work, (13 min. color film)
(Barr Films, 1981)

Feast or Famine? The Energy Future, by Franklyn Branley
(New York: Thomas Y. Crowell Company, 1980)

Powers of Nature (filmstrip)
(Washington, D.C.: National Geographic Society, 1973)

Where Are You Going with That Energy?, by Roy Doty and Leonard Marr
(New York: Doubleday & Co., Inc., 1977)

II, 2. Science Experiments with Sound, by Harry Sootin
(New York: W. W. Norton & Co., 1964)

Sound and Recording, by Keith Wicks
(New York: Franklin Watts, Inc., Warwick Press, 1982)

Thunder, Singing Sands, and Other Wonders: Sound in the Atmosphere, by Kenneth Heuer
(New York: Dodd, Mead, Co., 1981)

Wonders of Sound, by Rocco Ferauolo
(New York: Dodd, Mead & Co., 1962)

II, 3. Dining on a Sunbeam: Food Chains and Food Webs, by Phyllis S. Busch
(New York: Four Winds Press, 1973)

How to Grow a Jelly Glass Farm, by Kathy Mandry and Joe Toto
(New York: Pantheon Books, 1974)

Making a Native Plant Terrarium, by D. J. Herda
(New York: Julian Messner, 1977)

Putting the Sun to Work, by Jeanne Bendick
(Champaign, IL: Garrard Publishing Company, 1979)

The Sun: Earth's Star (20 min. color film to rent)
(National Geographic Society, Educational Services, 1980)

Terrariums, by Alice Parker
(New York: Franklin Watts, Inc., 1977)

The True Book of Weather Experiments, by Illa Podendorf
(Chicago: Children's Press, 1961)

Who Stole the Water (10 min. color film/video to rent)
(Macmillan Films, 1975)

II, 4. Factory Made: How Things are Manufactured, by Leonard Gottlieb
(Boston, MA: Houghton Mifflin, Co., 1978)

From Apple Seed to Applesauce, by Hannah Lyons Johnson
(New York: Lothrop, Lee, & Shepard Books, 1978)

How's It Made?: A Photo Tour of Seven Small Factories, by Stephen Lewis
(New York: William Morrow & Co., 1977)

How Things are Made
(Washington, D.C.: National Geographic Society, 1981)

Your Career in Energy-Related Occupations, by George Davis
(New York: Arco Publishing Co., 1980)

Toast (12 minute film)
(NYS Energy Office, AV Library, 2 Rockefeller Plaza, Albany, NY 12223, 1977)

II, 5. Experiments with Heat, by Harry Soutin
(New York: W. W. Norton & Co., 1964)

Heat, by Vicki Cobb
(New York: Franklin Watts, Inc., 1973)

Heat and Its Uses, by Irving and Ruth Adler
(New York: Harper & Row, John Day Junior Books, 1973)

Hot and Cold, by Irving Adler
(New York: Harper & Row, John Day Junior Books, 1975)

Hot as an Ice Cube, by Philip Balestrino
(New York: Thomas Y. Crowell Company, 1971)

II, 6. Energy Conservation: Experiments You Can Do . . . from Edison
(Southfield, MI: Thomas Alva Edison Foundation, 1981)

II, 7. Flash, Crash, Rumble, and Roll, by Franklyn M. Branley
(New York: Thomas Y. Crowell Company, 1964)

The Lightning and Thunder Case (animated film or video to rent)
(Learning Corporation of America, 1981)

II, 8. Making Electricity Work, by John M. Kennedy
(New York: Thomas Y. Crowell Company, 1959)

Wires and Watts, by Irwin Math
(New York: Charles Scribner's Sons, 1981)

II, 9. Experiments with Electric Currents, by Harry Sootin
(New York: W. W. Norton & Co., 1969)

The Magic of Electricity, by Sam Rosenfeld
(New York: Lothrop, Lee & Shepard Books, 1963)

II, 10. Saving Electricity, by Sam and Beryl Epstein
(Champaign, IL: Garrard Publishing Co., 1977)

II, 11. Cup and Saucer Chemistry, by Nathan Shalit
(Morristown, NJ: Shalit Literary Service, 1983)

First Chemistry Book for Boys and Girls, by Alfred Powell Morgan
(New York: Charles Scribner's Sons, 1977)

Kitchen Chemistry: Science Experiments to Do at Home, by Robert Gardner
(New York: Julian Messner, 1982)

Messing Around with Baking Chemistry: A Children's Museum Activity Book, by Bernie Zubrowski
(Boston, MA: Little, Brown & Co., 1981)

II, 13. Conservation of Energy, by Jane Werner Watson
(New York: Franklin Watts, Inc., 1978)

Energy Monsters: How to Starve Them, (film 13 min, color to rent)
(BFA Educational Media, 1978)

Future Sources, by John Satchwell
(New York: Franklin Watts Inc., 1981)

Oil, by Barbara Lowery
(New York: Franklin Watts Inc., 1977)

The Alternate Energy Suite (tape cassette and supplementary materials)
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Matrix

The matrix on the following pages is taken from the draft edition of the New York State Education Department's elementary science syllabus.

The state syllabus divides learning objectives into three categories:

understandings,
skills, and
attitudes.

In Energy and Safety, the major state objectives addressed are listed on the first page of each activity, in a box, under the titles "Understandings," "Skills," and "Attitudes," as in the state syllabus. However, any given activity actually addresses many objectives. This matrix is designed to show all the objectives that are introduced, taught, or reinforced by each activity. Its purpose is to help teachers use the Energy and Safety activities in conjunction with the state syllabus.

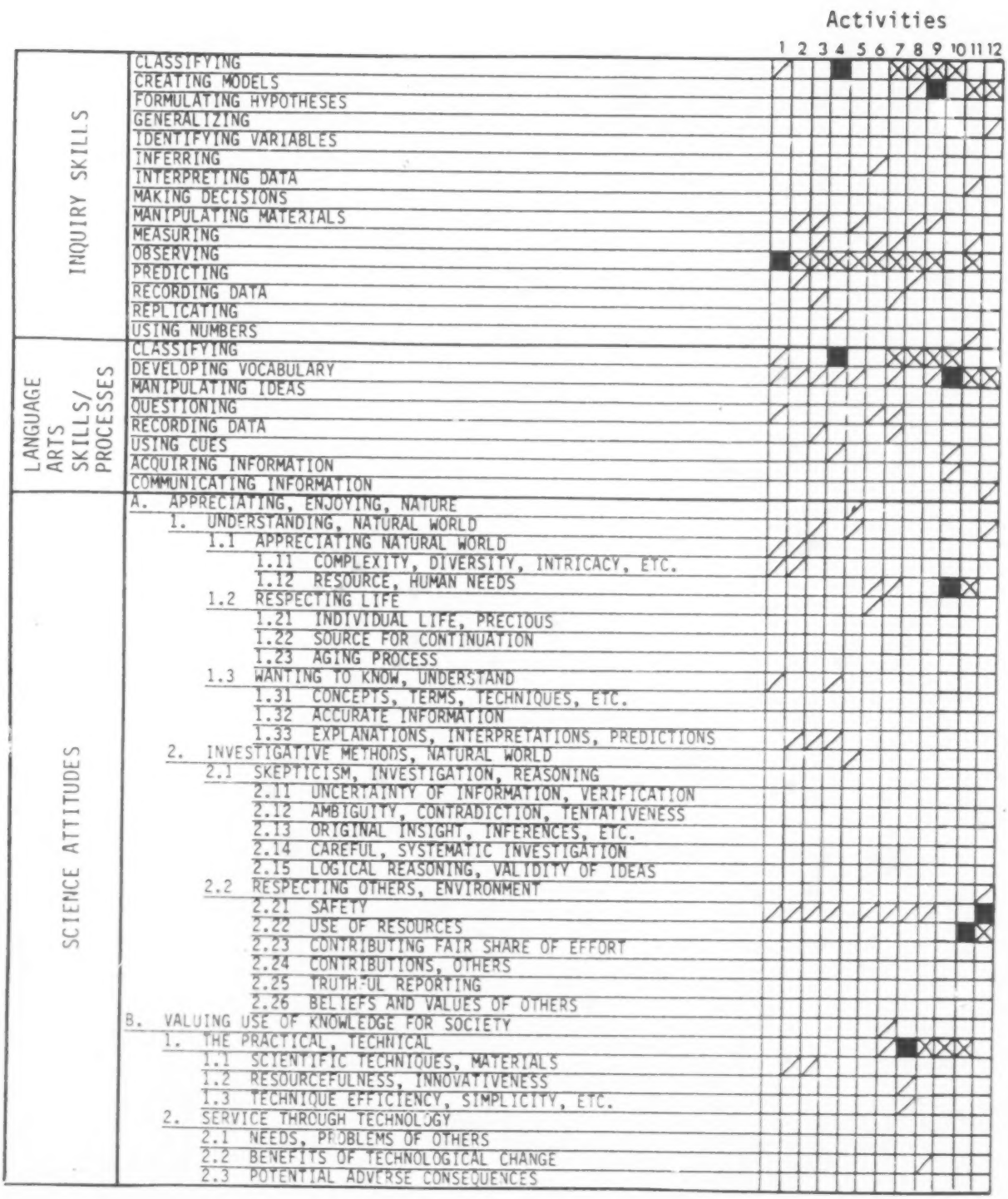
Key:

☒ means the activity introduces this understanding, skill or attitude.

■ means the activity teaches this understanding, skill or attitude.

☒ means the activity reinforces this understanding, skill, or attitude.

SYLLABUS - PROGRAM CORRELATION CHART
Level I, Grades K-2



Level I continued

Activities 1 2 3 4 5 6 7 8 9 10 11 12

LIFE SCIENCE (LEVEL 1)

1. NATURAL WORLD

1A. PLANTS, ANIMALS, NEEDS

1. PLANTS, PROPERTIES, NEEDS

1.1 PLANT PARTS, FUNCTIONS

1.11 ROOTS

1.12 LEAVES

1.13 STEMS, STALKS, TRUNKS, ETC.

1.2 PLANT PARTS, IMMEDIATE NEEDS

1.3 PLANT PARTS, SEASONAL CHANGES

1.4 PLANT GROWTH AND DEVELOPMENT, LIFE SPAN

1.41 SEED, SEEDLING, ADULT

1.42 BULB, SEEDLING, ADULT

1.43 LENGTH OF LIFE SPAN

1.5 PLANT PART VARIATIONS

2. ANIMALS, PROPERTIES, NEEDS

2.1 ANIMAL PARTS, FUNCTIONS

2.11 WINGS, LEGS, FINS

2.12 MOUTH, TEETH, JAWS, TONGUE

2.13 NOSTRIL

2.14 EYES, NOSE, EAR, TONGUE, SKIN

2.15 CLAWS, SHELLS, ETC.

2.16 BODY COVERING

2.17 PARTS, SOUND

2.2 ANIMAL PARTS, IMMEDIATE NEEDS

2.3 ANIMAL PARTS, SEASONAL NEEDS

2.4 ANIMAL GROWTH AND DEVELOPMENT, LIFE SPAN

2.41 INFANCY TO ADULT STAGES

2.42 LENGTH OF LIFE SPAN

2.5 ANIMALS, CONTROL CONDITIONS, NEEDS

2.6 ANIMALS, MOTION, NEEDS

2.7 ANIMAL PART VARIATIONS

1B. PLANTS, ANIMALS, DEPENDENCY

1. ANIMALS -- PLANTS

2. PLANTS -- ANIMALS

3. ANIMALS -- ANIMALS

PHYSICAL SCIENCE (LEVEL 1)

1C. OBJECTS, EVENTS, PROPERTIES

1. OBJECT PROPERTIES, MATERIAL, CONDITION

1.1 OBJECT PROPERTIES, MATERIAL

1.11 DIFFERENT MATERIALS/PROPERTIES

1.12 CHANGING SIZE, SHAPE

1.13 SOLID, LIQUID, GAS

1.14 MIXTURES

1.2 OBJECT PROPERTIES, LOCATION IN SPACE

1.3 OBJECT PROPERTIES, AMOUNT OF SPACE

1.4 TWO OBJECTS, SAME SPACE

1.5 OBJECT PROPERTIES, SURROUNDING CONDITIONS

2. EVENT PROPERTIES, OBJECTS, SPACE, TIME

2.1 EVENT, TIME, PLACE IN SPACE

2.2 EVENT, DURATION OF TIME

2.3 EVENTS, SEQUENCE, ORDER, SPACE

2.4 TWO EVENTS, TIME

2.5 REPEATING EVENTS, INTERVALS OF TIME

2.6 EVENTS, MOTION, SPACE

1D. INTERACTION, OBJECTS, EVENTS

1. OBJECTS -- HEAT

1.1 HEATING, COOLING, WARMER, COLDER

1.2 HEATING MATERIALS, LIQUIDS, GASES

1.3 COOLING MATERIAL, LIQUIDS, SOLIDS

1.4 HEATING, COOLING, VOLUME CHANGE

2. OBJECT, MOTION, PUSH-PULL

2.1 DIRECTION OF PUSH-PULL, CHANGE IN MOTION

2.2 SIZE OF PUSH-PULL, OBJECT MASSIVENESS, MOTION

2.3 SURFACE CONDITION, SIZE OF PUSH-PULL, MOTION

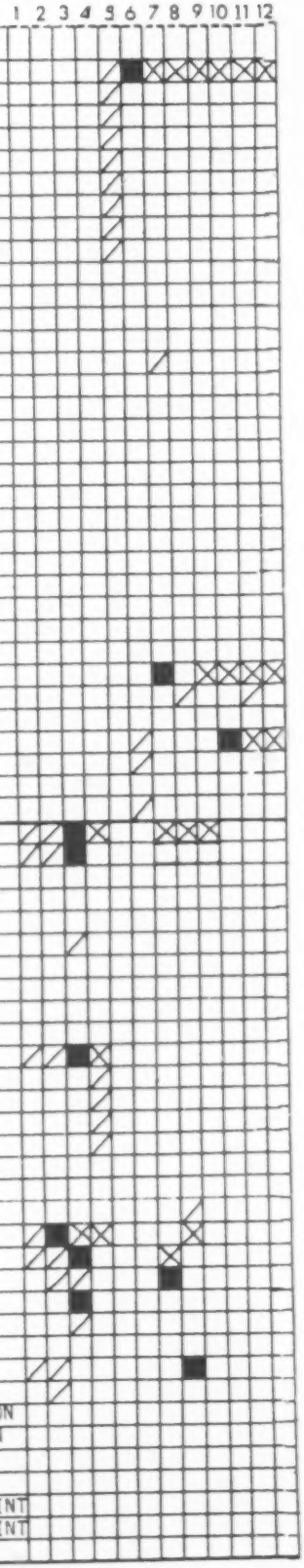
3. OBJECTS, SUPPORTED BY OBJECTS

3.1 UNIFORM BALANCE BEAM

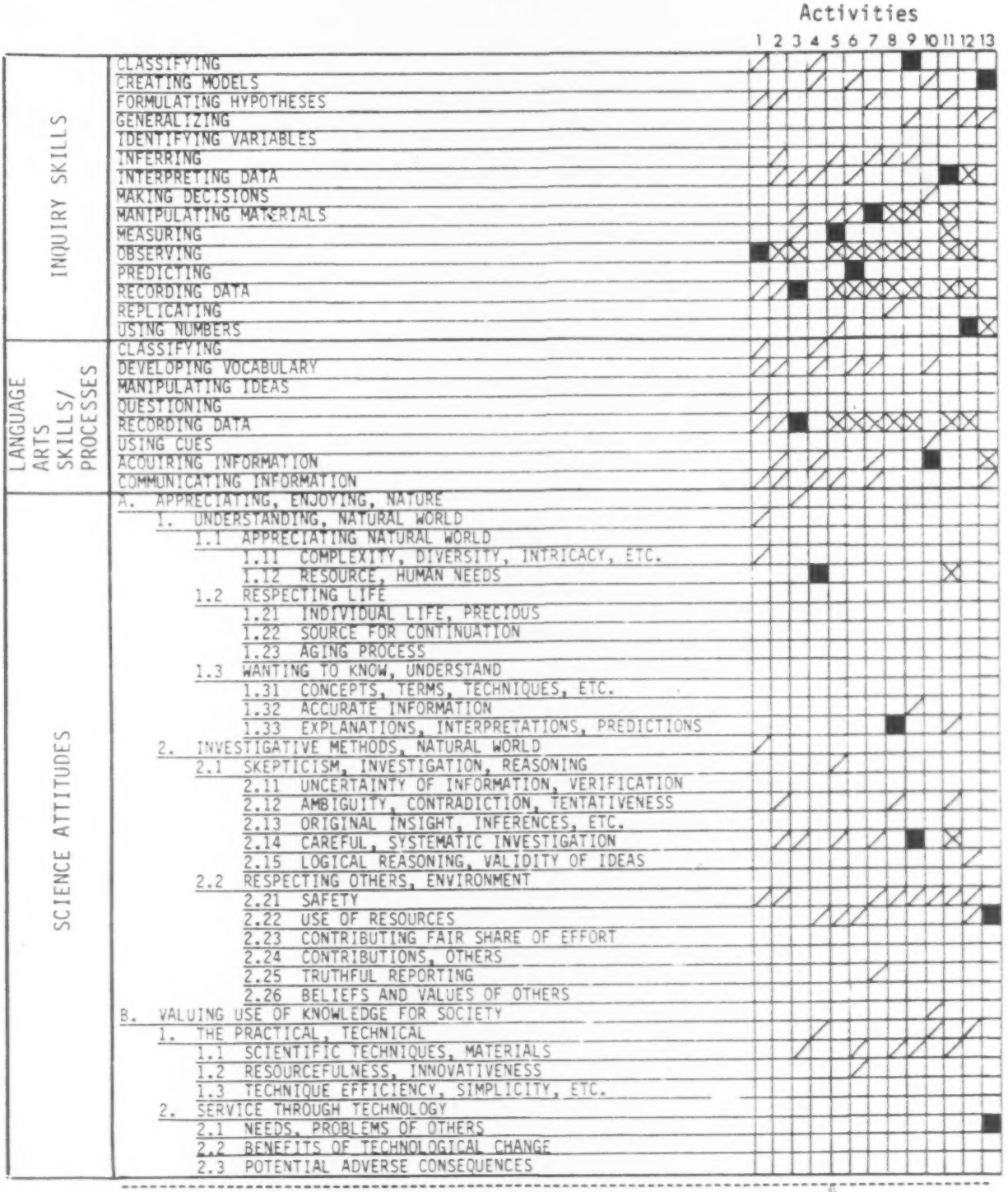
3.11 TWO OBJECTS, EQUAL WEIGHT, BALANCE POINT

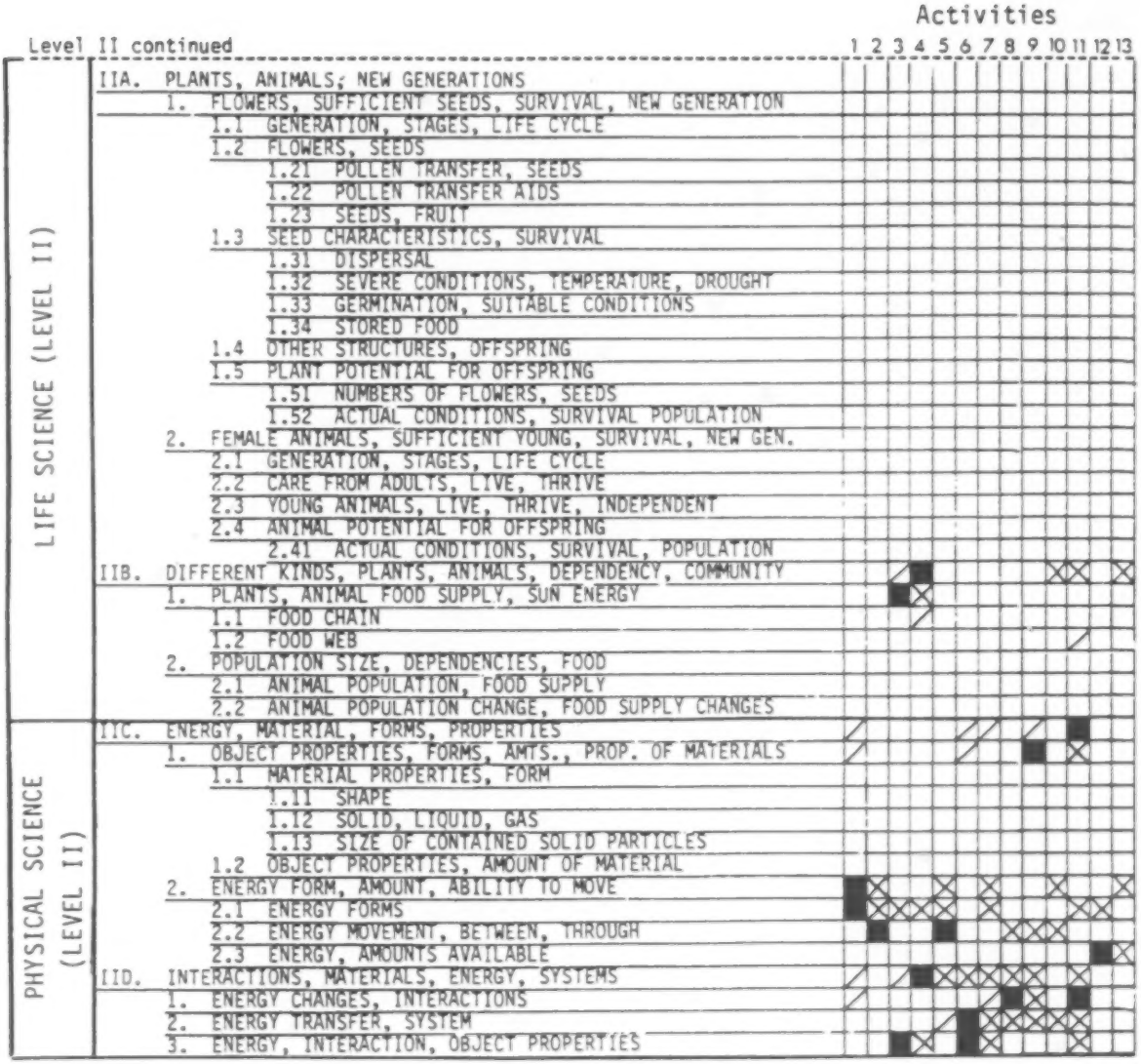
3.12 TWO OBJECTS, DIFF. WEIGHT, BALANCE POINT

3.2 OBJECTS, FLOATING, SINKING

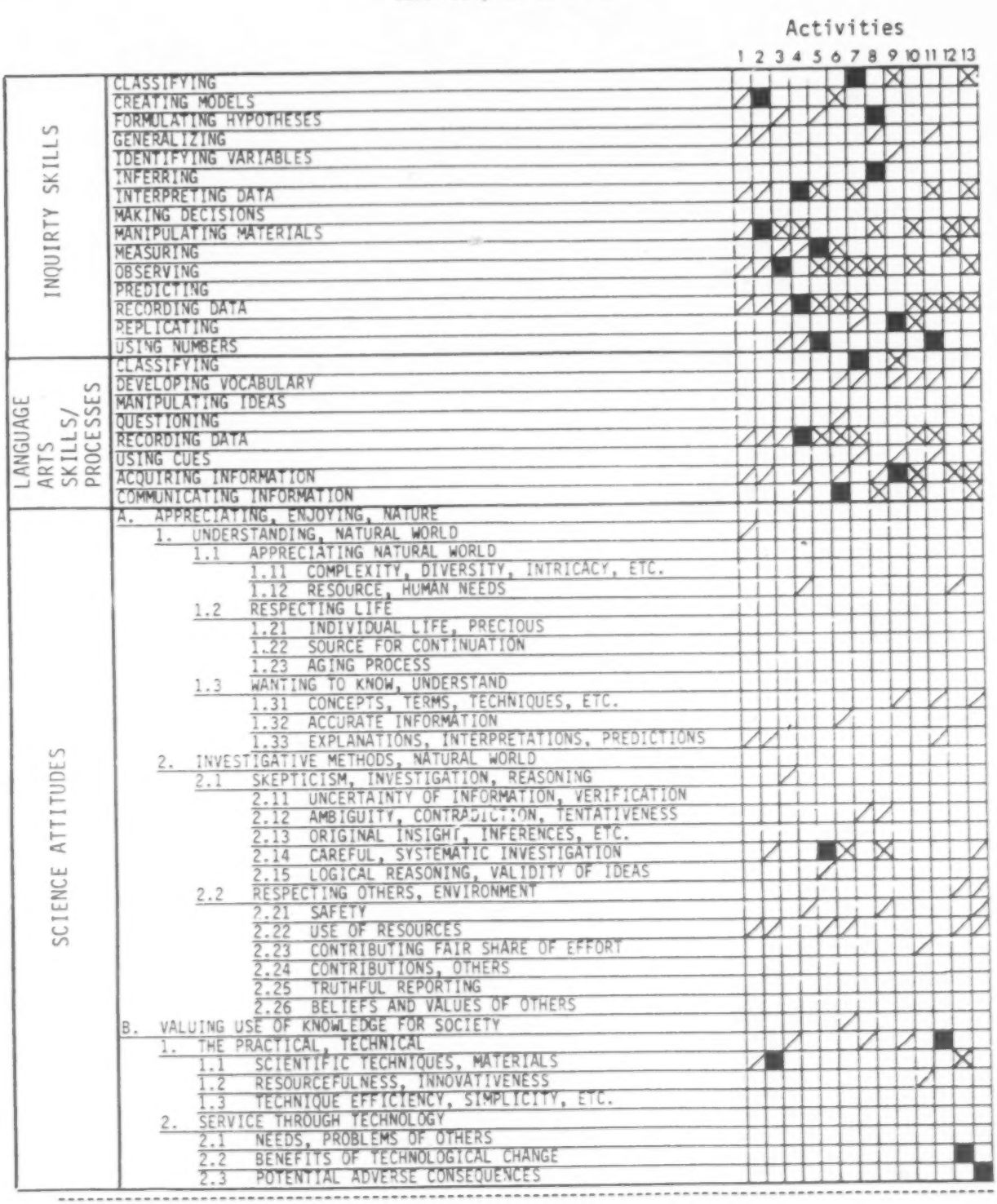


SYLLABUS - PROGRAM CORRELATION CHART
LEVEL II, GRADES 3-4




Activities
1 2 3 4 5 6 7 8 9 10 11 12 13
Level II continued
LIFE SCIENCE (LEVEL II)
PHYSICAL SCIENCE (LEVEL II)
IIA. PLANTS, ANIMALS; NEW GENERATIONS
1. FLOWERS, SUFFICIENT SEEDS, SURVIVAL, NEW GENERATION
1.1 GENERATION, STAGES, LIFE CYCLE
1.2 FLOWERS, SEEDS
1.21 POLLEN TRANSFER, SEEDS
1.22 POLLEN TRANSFER AIDS
1.23 SEEDS, FRUIT
1.3 SEED CHARACTERISTICS, SURVIVAL
1.31 DISPERSAL
1.32 SEVERE CONDITIONS, TEMPERATURE, DROUGHT
1.33 GERMINATION, SUITABLE CONDITIONS
1.34 STORED FOOD
1.4 OTHER STRUCTURES, OFFSPRING
1.5 PLANT POTENTIAL FOR OFFSPRING
1.51 NUMBERS OF FLOWERS, SEEDS
1.52 ACTUAL CONDITIONS, SURVIVAL POPULATION
2. FEMALE ANIMALS, SUFFICIENT YOUNG, SURVIVAL, NEW GEN.
2.1 GENERATION, STAGES, LIFE CYCLE
2.2 CARE FROM ADULTS, LIVE, THRIVE
2.3 YOUNG ANIMALS, LIVE, THRIVE, INDEPENDENT
2.4 ANIMAL POTENTIAL FOR OFFSPRING
2.41 ACTUAL CONDITIONS, SURVIVAL, POPULATION
IIB. DIFFERENT KINDS, PLANTS, ANIMALS, DEPENDENCY, COMMUNITY
1. PLANTS, ANIMAL FOOD SUPPLY, SUN ENERGY
1.1 FOOD CHAIN
1.2 FOOD WEB
2. POPULATION SIZE, DEPENDENCIES, FOOD
2.1 ANIMAL POPULATION, FOOD SUPPLY
2.2 ANIMAL POPULATION CHANGE, FOOD SUPPLY CHANGES
IIC. ENERGY, MATERIAL, FORMS, PROPERTIES
1. OBJECT PROPERTIES, FORMS, AMTS., PROP. OF MATERIALS
1.1 MATERIAL PROPERTIES, FORM
1.11 SHAPE
1.12 SOLID, LIQUID, GAS
1.13 SIZE OF CONTAINED SOLID PARTICLES
1.2 OBJECT PROPERTIES, AMOUNT OF MATERIAL
2. ENERGY FORM, AMOUNT, ABILITY TO MOVE
2.1 ENERGY FORMS
2.2 ENERGY MOVEMENT, BETWEEN, THROUGH
2.3 ENERGY, AMOUNTS AVAILABLE
IID. INTERACTIONS, MATERIALS, ENERGY, SYSTEMS
1. ENERGY CHANGES, INTERACTIONS
2. ENERGY TRANSFER, SYSTEM
3. ENERGY, INTERACTION, OBJECT PROPERTIES

SYLLABUS - PROGRAM CORRELATION CHART
Level III, Grades 5 - 6



Level III, continued

Activities 1 2 3 4 5 6 7 8 9 10 11 12 13

LIFE SCIENCE (LEVEL III)

IIIA. LIVING THINGS, AFFECT ON ENVIRONMENT
- 1. LIFE OF PLANT, ENVIRONMENTAL CONDITIONS
  - 1.1 PLANT HEALTH, GROWTH, DEVELOPMENT
  - 1.2 PLANT CHANGE, ENVIRONMENTAL CHANGE, SURVIVAL
    - 1.21 PLANT PART MOVEMENT
    - 1.22 PLANT PART FORMATION
  - 1.3 GREEN PLANT, LIGHT FORMATION
    - 1.31 LEAVES, LIGHT ABSORPTION, ENERGY TRANSFORM.
    - 1.32 ABSORBED AND STORED ENERGY, UTILIZATION
    - 1.33 STORED ENERGY, FOOD SUPPLY, SEED, GROWING PLANT
  - 1.4 PLANT, AFFECT, ENVIRONMENT
- 2. LIFE OF ANIMAL, ENVIRONMENTAL CONDITIONS
  - 2.1 ANIMAL HEALTH, GROWTH, DEVELOPMENT
  - 2.2 ANIMAL BEHAVIOR CHANGE, ENVIRONMENTAL CHANGE
    - 2.21 ANIMALS MOVEMENT, OPTIMAL CONDITIONS
    - 2.22 ANIMAL CHARACTERISTICS, ENVIRON. INFLUENCE
    - 2.23 ROUTINE BEHAVIOR, ENVIRONMENTAL INFLUENCE
  - 2.3 SOURCES OF ENERGY
    - 2.31 STORED ENERGY, FOOD
    - 2.32 HEAT ENERGY, SUN
    - 2.33 HEAT ENERGY, FUEL UTILIZATION
  - 2.4 ANIMAL BEHAVIOR, AFFECT, ENVIRONMENT

IIIB. ENVIRON. CONDITIONS, INFLUENCE, POPULATIONS, COMMUNITY
- 1. DIFFERENT KINDS, POPULATIONS, VARIOUS ENVIRONMENTS
- 2. ENVIRONMENTAL CONDITION CHANGE, POPULATION SIZE CHANGE
  - 2.1 CONDITIONS, DIRECT EFFECT, POPULATION SIZES
  - 2.2 CONDITIONS, DIRECT EFFECT, FOOD CHAIN

PHYSICAL SCIENCE (LEVEL III)

IIIC. ENERGY, WITHIN MATERIAL, POSITION, MOTION, OBJECTS
- 1. ENERGY TRANSFER WITHIN MATERIALS
  - 1.1 ELECTRICAL ENERGY, CIRCUITS
    - 1.11 POSITIVE, NEGATIVE CHARGES
    - 1.12 BATTERIES, ENERGY STORAGE
    - 1.13 COMPLETE CIRCUIT, ENERGY FLOW
    - 1.14 RATE OF FLOW, VOLTAGE, TRANSFER AMOUNT
    - 1.15 MAGNETIC FIELD, FLOWING ELECTRICITY
    - 1.16 MOVING MAGNET, FLOW OF ELECTRICITY
  - 1.2 INTERACTIONS, MATERIALS, ENERGY
    - 1.21 NEW MATERIALS
    - 1.22 STARTING ENERGY
    - 1.23 ENERGY EMITTED
    - 1.24 ENERGY ABSORBED
  - 1.3 HEAT FLOW
    - 1.31 AMOUNT OF MATERIAL
    - 1.32 TYPES OF MATERIAL
    - 1.33 TEMPERATURE DIFFERENCE
    - 1.34 MOVEMENT OF MATERIAL
- 2. ENERGY TRANSFER, MOTION, OBJECTS
  - 2.1 WORK, ENERGY TRANSFER
    - 2.11 LIFTING OBJECTS, HEAVY
    - 2.12 MOVING OBJECTS, SPEED
  - 2.2 AMOUNT OF WORK, FORCE, DISTANCE
    - 2.21 INCLINED PLANE, LEVER, CHANGING FORCE
    - 2.22 SIMPLE MACHINES, CHANGING DISTANCE
    - 2.23 MACHINE, OBJECT-FORCE-DISTANCE RELATIONSHIP
  - 2.3 MAN-MADE TOOLS, MACHINES
  - 2.4 FORCES, LIQUIDS, GASES
    - 2.41 CLOSED CONTAINER, FORCE
    - 2.42 FORCE, AREA, PRESSURE
    - 2.43 PRESSURE, DEPTH, FLUID

IIID. MATERIAL AND ENERGY TRANSFER, INTERACTIONS, SYSTEMS
- 1. CHANGES IN FORM
- 2. CHANGES IN LOCATION
- 3. LOSSES FROM A SYSTEM
- 4. MAINTAINING INTERACTIONS

Level III, continued

ECOSYSTEMS		Activities 1 2 3 4 5 6 7 8 9 10 11 12 13
	IIIE. ECOSYSTEM	
	1. MATERIAL RECYCLING, PHYS. ENVIRON., LIVING COMMUNITY	✓ ✓ ✓
	1.1 MATERIAL, ABSORPTION, GREEN PLANTS	
	1.2 MATERIAL ABSORPTION, ANIMALS	
	1.3 MATERIAL UTILIZATION, WASTE	
	1.4 MATERIAL DECAY	
	2. ENERGY EXCHANGES, PHYS. ENVIRON., LIVING COMMUNITY	✓ ✓ ✓
	2.1 ENERGY INPUT, PHYSICAL ENVIRONMENT	
	2.11 ENERGY ABSORPTION, AIR, WATER, LAND	
	2.12 ENERGY EXCHANGES, CLOUDS, RAIN	
	2.13 ENERGY EXCHANGES, WINDS, WAVES	
	2.2 ENERGY INPUT, LIVING COMMUNITY	✓
	2.21 SOLAR ENERGY, ABSORP., GREEN PLANT UTIL.	✓
	2.22 STORED ENERGY, PLANS, ANIMAL UTILIZATION	
	2.23 ENERGY EXCH., DEAD PLANTS-ANIMAL, DECAY	
	3. INTERACTIONS, CAUSE AND EFFECT, ECOSYSTEM PARTS	✓ ■

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